CHK POWER QUALITY Pty Ltd
Address: Unit 102, 25 Angas Street
Meadowbank NSW 2114, Sydney Australia
Website: www.chkpowerquality.com.au
Telephone: +61 2 8283 6945
Fax: +61 2 8212 8105
ABN: 53 169 840 831

MIRRIN

Multi-Channel Load Logger

MODEL: LL400

User Manual

Address: Unit 102, 25 Angas Street
Meadowbank NSW 2114, Sydney Australia
Website: www.chkpowerquality.com.au
Telephone: +61 2 8283 6945
Fax: +61 2 8212 8105
ABN: 53 169 840 831

Contents

1 GETTING STARTED 5
1.1 BRIEF 5
1.2 FEATURE SUMMARY 5
1.3 POWER UP 5
1.4 CONNECTIONS 6
1.5 KIT7
1.5.1 Accessories 8
1.5.2 Options 9
1.6 POWER MODES 9
1.7 INTERNAL BATTERIES 9
1.8 CURRENT SENSORS 9
2 CITRUS APPLICATION SOFTWARE 11
2.1 INSTALLING THE CITRUS APPLICATION SOFTWARE 11
2.2 INSTALLING AN FTDI USB TO SERIAL DRIVER 12
THE FTDI USB TO SERIAL DRIVER IS INSTALLED. 14
2.3 ESTABLISHING COMMUNICATIONS 14
2.3.1 Pairing your computer to a Bluetooth enabled Mirrin 14
2.3.2 Establishing an access point for a WiFi enabled Mirrin 17
2.3.3 Connecting to the Mirrin 20
2.4 STATUS WINDOW 21
2.4.1 Date and time 21
2.4.2 Boot counter 22
2.4.3 Battery indicator 22
2.4.4 Log memory 22
2.4.5 Inputs 22
2.4.6 Serial number 22
2.4.7 Model 23
2.4.8 Firmware 23
2.4.9 Status 23
2.5 SET TIME 23
2.6 SET LOG START / STOP 24
2.7 CONFIGURATION 25
2.7.1 Log interval 26
2.7.2 Memory fill options 26
2.7.3 Total harmonic distortion (THD) 27
2.7.4 Temperature channels 27
2.7.5 Alarm settings 27
2.7.5.1 Upper and lower thresholds 28
2.7.5.2 Hysteresis and minimum duration 28
2.7.6 Memory card 29
2.7.7 Display time option for maximum value 29
2.7.8 Power saving mode 29
2.7.9 Reset to default 29

2.7.10 Save config 30
2.8 UPGRADE FIRMWARE 30
2.9 DOWNLOADING DATA 33
2.10 CLEAR MEMORY 34
2.11 LOCK 36
2.12 OPEN DATA FILE 37
2.12.1 Active channels 37
2.12.1.1 Additional active channels 37
2.12.1.2 Trace selection 38
2.12.2 Adjusting scales 39
2.12.2.1 Moving axis 41
2.12.2.2 Changing axis range 42
2.12.2.3 Zooming 43
2.12.3 Title 44
2.12.4 Generate a PDF 45
2.12.5 Export CSV 47
2.12.6 Export to LoggerView 48
2.12.7 Show table 48
2.12.8 Show alarms 49
2.12.9 Add another file 49
3 CITRUS LITE APPLICATION SOFTWARE 51
3.1 CITRUS LITE ANDROID SOFTWARE APPLICATION 51
3.1.1 Installing the Citrus Lite Android software application 51
3.1.2 Connecting to the MLL using Citrus Lite 53
3.1.3 Status 56
3.1.3.1 Serial number 57
3.1.3.2 Firmware version 57
3.1.3.3 Date and time 58
3.1.3.4 Boot counter 58
3.1.3.5 Log status 59
3.1.4 Configuration 59
3.1.5 Clear data 60
3.1.6 Download data 61
3.1.7 Send data 62
3.1.8 Lock / Unlock 64
3.2 CITRUS LITE IOS SOFTWARE APPLICATION 66
3.2.1 Installing the Citrus Lite iOS software application 66
3.2.2 Configuring the iOS device 68
4 OPERATION 70
4.1 FIELD INSTALLATION PROCEDURE 70
4.1.1 Flanged enclosure 70
4.1.2 Backplane 70
4.2 BATTERY REPLACEMENT 72
5 SERVICE AND SUPPORT 73
5.1 CALIBRATION 73
5.2 EQUIPMENT MAINTENANCE 73

Address: Unit 102, 25 Angas Street
Meadowbank NSW 2114, Sydney Australia
Website: www.chkpowerquality.com.au
Telephone: +61 2 8283 6945
Fax: +61 2 8212 8105
ABN: 53 169 840 831

5.3 CLEANING AND DECONTAMINATION 73
5.4 TECHNICAL SUPPORT 73
6 SPECIFICATIONS 74

Address: Unit 102, 25 Angas Street
Meadowbank NSW 2114, Sydney Australia
Website: www.chkpowerquality.com.au
Telephone: +61 2 8283 6945
Fax: +61 2 8212 8105
ABN: 53 169 840 831

1 Getting Started

1.1 Brief

The **Mirrin** Multi Channel Load Logger (MLL) measures AC RMS current (load) up to four channels and is ideal for monitoring loads on circuits and switchboards to record load profiles that can be used to identify slow changing events such as long duration interruptions, outages and derive estimates of usage patterns. The MLL is also useful as a diagnostic tool to assess load sharing on single phase circuits and load balancing on three phase systems.

The MLL incorporates a Liquid Crystal Display (LCD) which shows the maximum current measurement in each channel together with the date-time stamp of its occurrence and therefore ideally suited as a Maximum Demand Indicator (MDI).

The MLL is generally asleep and wakes up four times a second (every 250ms) and takes a measurement by sampling the input at 1600Hz. The aggregated measurements are committed to memory (logged).

The maximum current reading is based on the instantaneous readings with a sixty-second exponential time constant.

The MLL is housed in a small light-weight polycarbonate weatherproof box.

1.2 Feature summary

- Logs four (4) current channels (standard) and two (2) temperature channels (optional);
- Programmable logging interval, minimum one second;
- programmable alarms;
- Over two years memory capacity at 10 minute logging interval (8GB SD card included);
- Displays the maximum demand and maximum temperature with a date-time stamp for each channel;
- Local wireless options: Bluetooth or Wi-Fi enabled;
- Android and iOS Apps that provide for online measurements, graphical displays and options to download data and email;
- Battery operated with power saving mode to extend battery life to near 12 months;
- Facility for external DC power source including solar charging; and
- Suitable for indoor and outdoor applications.

1.3 Power up

The MLL will power up and enable logging only when it detects a current sensor connected to one of the four terminals. This is intended so that battery energy is better conserved when not in use. The MLL will still power when energised via the communications cable but will not commence logging.

1.4 Connections

(A) LEDs:

Two LEDs exist at the top of the unit.

- **Heartbeat:** when active will flash blue every sixty (60) seconds.
- **Low battery / malfunction:** When active will flash red every sixty (60) seconds.

(B) Button:

The unit is normally in sleep mode. When the button is pressed it will activate the LCD and Bluetooth or Wi-Fi for sixty (60) seconds.

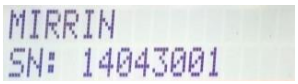
If the button is pressed for five (5) seconds (long press) and then released, the unit will display the message on the right. Another long press will clear the minimum and maximum values. No logged data is erased.

(C) Liquid Crystal Display(LCD):

The LCD shows ten (10) pages for the standard unit and fourteen (14) pages if temperature

option is included. Examples of page displays are shown on the right hand side. Each page is displayed for three (3) seconds.

- **Page 1:** Name and serial number.
- **Page 2:** Percentage of log capacity filled and firmware version.
- **Pages 3-10:** Current and maximum current measurements for channels A, B, C and N.
- **Pages 11-14:** Temperature and maximum temperature measurements for channels T1 and T2.

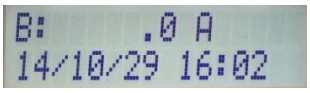


Page 1

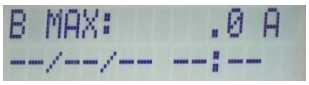
Page 2

Page 3

Page 4



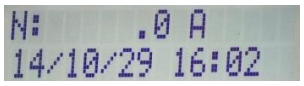
Page 5



Page 6

Page 7

Page 8



Page 9

Page 10

Page 11

Page 12

Page 13

Page 14

(D) Current channels:

Designated as A, B, C, and N.

(E) Port:

Used for USB communications and for an external power adaptor.

(F) Temperature channels (optional):
Two external temperatures available for correlating current and temperature measurements.

1.5 Kit

Includes:

- MLL;
- Four (4) flexible current sensors (600mm in length);

- Communications cable;
- Application software for PC (Citrus);
- Application software for Android and iOS based devices (Citrus Lite); and
- Carry bag.

1.5.1 Accessories

Communications cable

Carry bag

Flexible current sensor
rated at 3000A (CATIV 600V)

Clamp-on current sensor
rated at 500A (CA TIV 600V)

Temperature sensor 5m

Temperature sensor 5m
(magnetic mount)

1.5.2 Options

Includes:

- Various flexible current sensors of smaller diameter;
- 15mm clamp-on current transformers;
- External power supplies:
  - Solar panel rated at 12V;
  - Parasitic clamp-on current transformer power supply;
  - USB supply via communications cable;
- Other inputs:
  - Two temperatures. Requires temperature connections on the MLL;
- Mounting:
  - Flanged case;
  - Magnetic feet; and
  - Holster.

1.6 Power modes

The unit detects its available power source and automatically switches to Sleep Mode if the power source is internal batteries. In this case, during normal operation, the LCD is blanked and Bluetooth or WiFi disabled. Measurements are performed in the background. The LCD and Bluetooth or WiFi are active for sixty (60) seconds when the button is pressed.

If the unit detects external power (via Port) then the LCD and Bluetooth or WiFi remain permanently enabled.

1.7 Internal batteries

The MLL is powered by two non-rechargeable 'AA' cell lithium batteries or a rechargeable battery pack supplied by the manufacturer.

Recommended ‘AA” size batteries include:

- Energizer® Ultimate Lithium AA Batteries; and the
- Alternative is the Varta Professional Lithium AA - Mignon (6106-1.5V).

Energizer® Ultimate Lithium

Figure 1.7.1

Varta Professional Lithium

Figure 1.7.2

1.8 Current sensors

The MLL is designed to interface to voltage output current sensors, which is standard with all flexible current sensors provided by CHK Power Quality Pty Ltd.

It is also possible to utilise the existing clamp-on current sensors (100A, 500A and 1000A) as provided for the MaxiAmp unit. This will require an adaptor for each.

Address: Unit 102, 25 Angas Street
Meadowbank NSW 2114, Sydney Australia
Website: www.chkpowerquality.com.au
Telephone: +61 2 8283 6945
Fax: +61 2 8212 8105
ABN: 53 169 840 831

The MLL will read 20% over-range for each current clamp and 50% over-range for each flexible current sensor.

2 Citrus Application Software

2.1 Installing the Citrus application software

Step 1: Click on the following link which takes you to the 'Downloads' page of the CHK Power Quality website http://www.chkpowerquality.com.au/downloads/

Step 2: On the 'Downloads' page click on 'Citrus Software' as shown in figure 2.1.1.

An executable file, as highlighted by the file icon shown in figure 2.1.2 and appears at the bottom left corner of your screen, will be downloaded to your computer and placed in the 'Downloads' folder. The file icon shows the version number of the 'Citrus software' which is 0.26 at the time of writing this document.

Figure 2.1.1

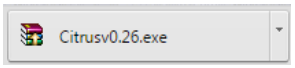


Figure 2.1.2

Step 3: Click on the file icon. The message box in figure 2.1.3 appears.

Step 4: Click the 'Run' button as shown in figure 2.1.3. The box in figure 2.1.4 appears.

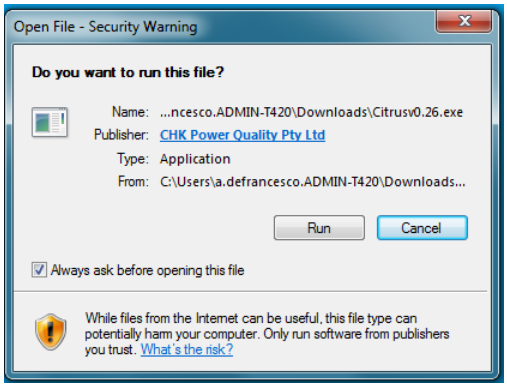


Figure 2.1.3

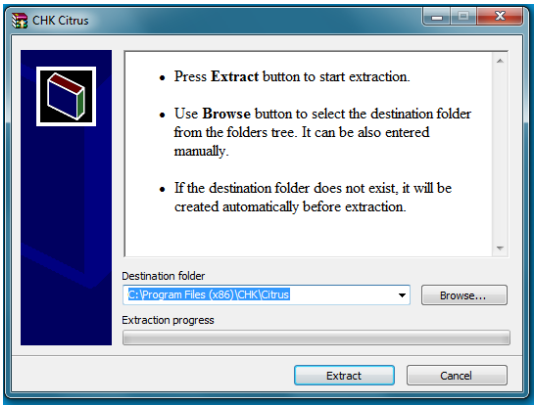


Figure 2.1.4

Step 5: Click the 'Extract' button shown in figure 2.1.4 to the desired location. The icon in figure 2.1.5 will appear on your desktop and in the start menu as shown in figure 2.1.6.

Figure 2.1.5

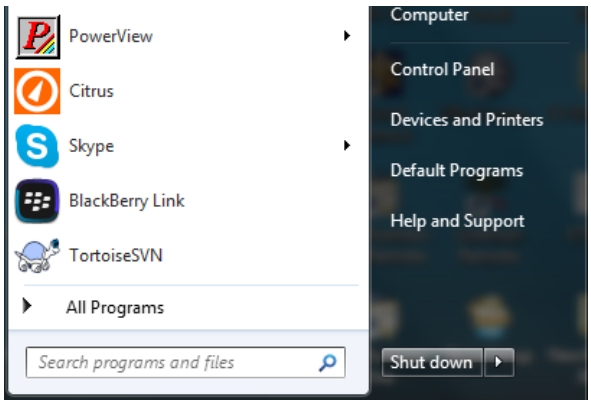


Figure 2.1.6

The Citrus application is installed.

2.2 Installing an FTDI USB to serial driver

Note: You may need to install an FTDI USB to serial driver. You can download a Virtual COM Port (VCP) driver which can be found at:
http://www.chkpowerquality.com.au/downloads/ or at
http://www.ftdichip.com/Drivers/VCP.htm

Step 1: Click on the following link which takes you to the 'Downloads' page of the CHK Power Quality website http://www.chkpowerquality.com.au/downloads/

Step 2: On the 'Downloads' page click on 'Virtual com port drivers' as shown in figure 2.2.1.

An executable file, as highlighted by the file icon shown in figure 2.2.2 and appears at the bottom left corner of your screen, will be downloaded to your computer and placed in the 'Downloads' folder.

Figure 2.2.1

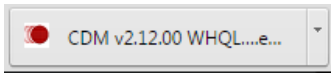


Figure 2.2.2

Step 3: Click on the file icon. The message box in figure 2.2.3 appears.

Step 4: Click the 'Run' button shown in figure 2.2.3. The box in figure 2.2.4 appears.

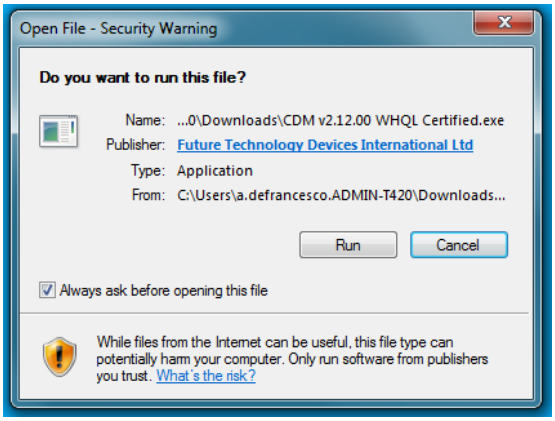


Figure 2.2.3

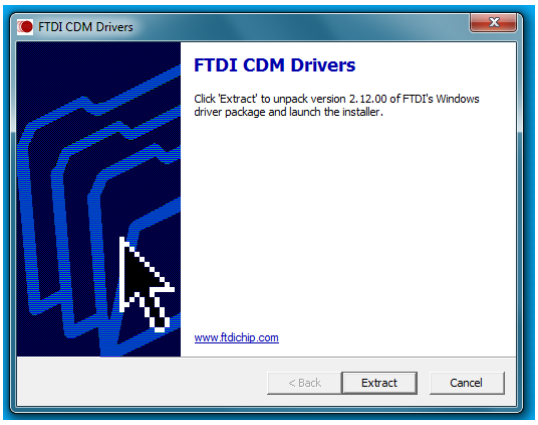


Figure 2.2.4

Step 5: Click the 'Extract' button shown in figure 2.2.4. The box in figure 2.2.5 appears.

Step 6: Click the 'Next' button shown in figure 2.2.5. The box in figure 2.2.6 appears.

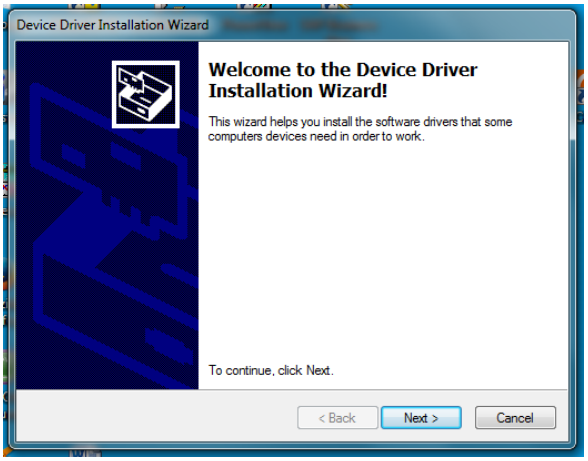


Figure 2.2.5

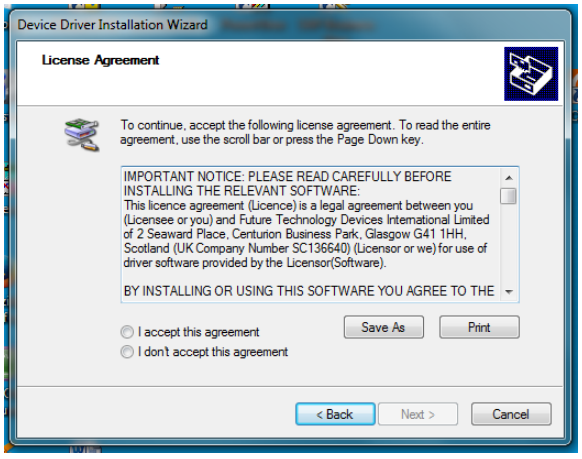


Figure 2.2.6

Step 7: Check (tick) 'I accept this agreement' as shown in figure 2.2.6. The 'Next' button becomes active as shown in figure 2.2.7.

Step 8: Click the 'Next' button shown in figure 2.2.7. The box in figure 2.2.8 appears.

Step 9: Click the 'Finish' button.

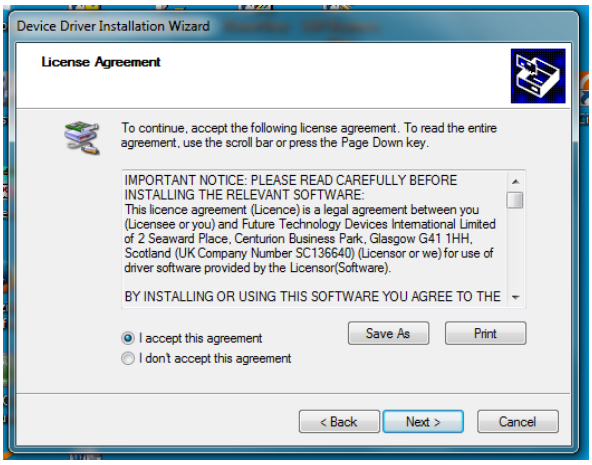


Figure 2.2.7

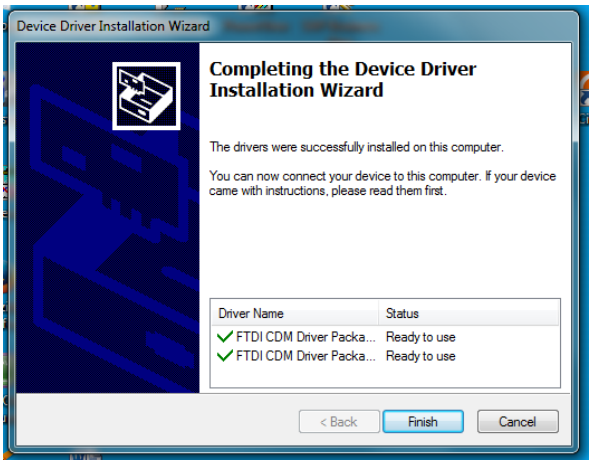


Figure 2.2.8

The FTDI USB to serial driver is installed.

2.3 Establishing communications

Depending upon the model, you can establish communications between your computer and the MLL using:

- a USB port with the cable provided; and
- Bluetooth (wireless); or
- WiFi (wireless).

2.3.1 Pairing your computer to a Bluetooth enabled Mirrin

Step 1: Go to the start menu and click on the control panel icon shown in figure 2.3.1.1. The window in figure 2.3.1.2 appears.

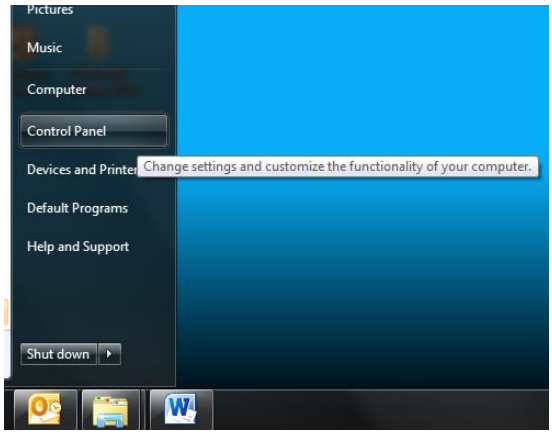


Figure 2.3.1.1

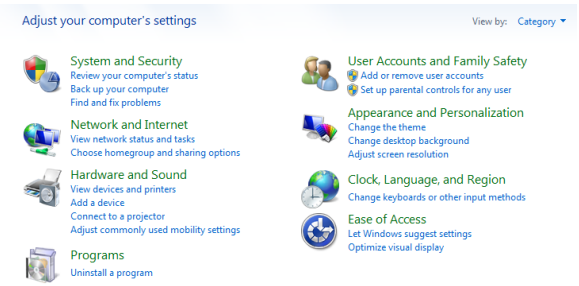


Figure 2.3.1.2

Step 2: Click on 'Hardware and Sound' as shown in figure 2.3.1.3. The window in figure 2.3.1.4 appears.

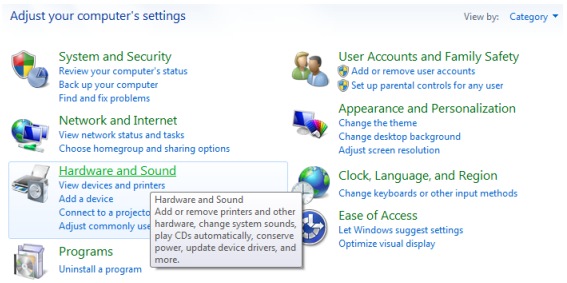


Figure 2.3.1.3

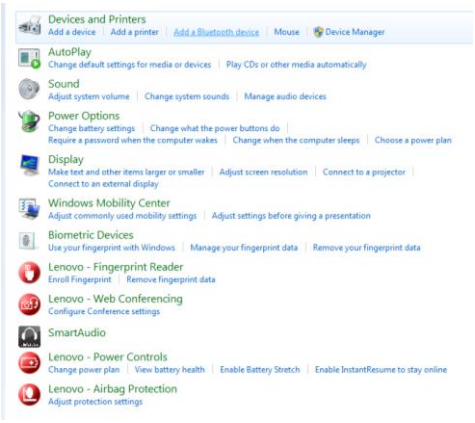


Figure 2.3.1.4

Step 3: Click on 'Add a Bluetooth device' as shown in figure 2.3.1.4. The window in figure 2.3.1.5 appears.

Step 4: Press the button on the MLL to activate the Bluetooth wireless module and wait a few seconds. The window will update with the MLL showing the serial number as shown in figure 2.3.1.6.

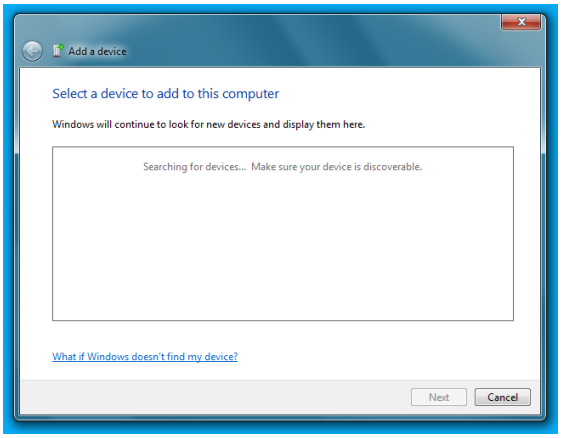


Figure 2.3.1.5

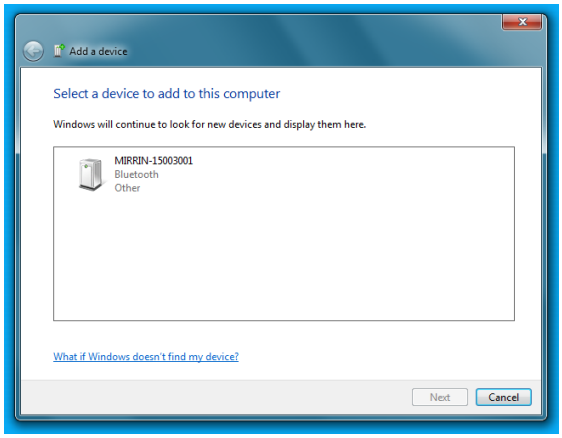


Figure 2.3.1.6

Step 5: Click on the device icon to select the device. The device icon is highlighted as shown in figure 2.3.1.7. The computer will attempt to connect to the device as shown in figure 2.3.1.8. Ensure the MLL is still active.

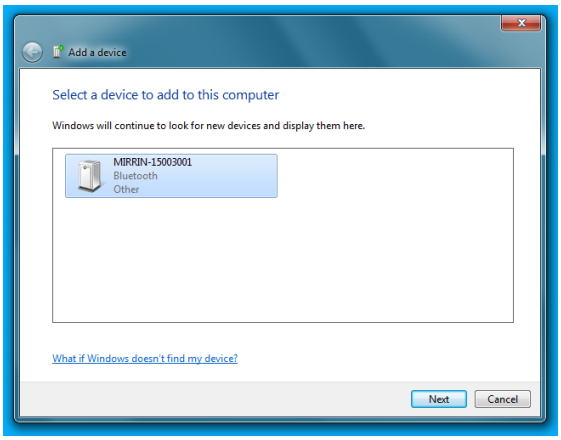


Figure 2.3.1.7

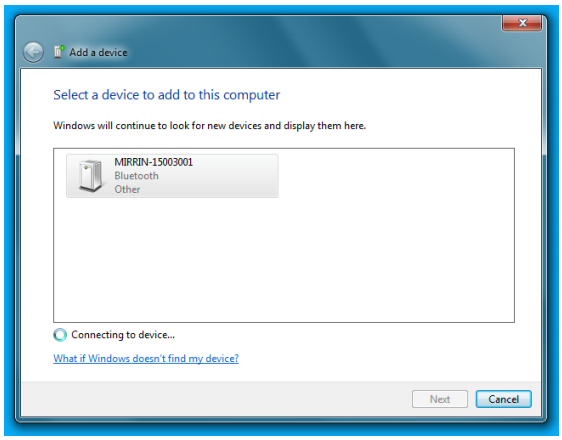


Figure 2.3.1.8

Step 6: The window in figure 2.3.1.9 appears. Click the 'Next' button. The computer is configuring the device as shown in figure 2.3.1.10.

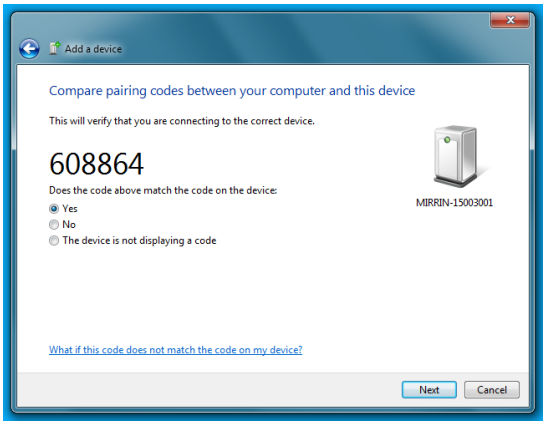


Figure 2.3.1.9

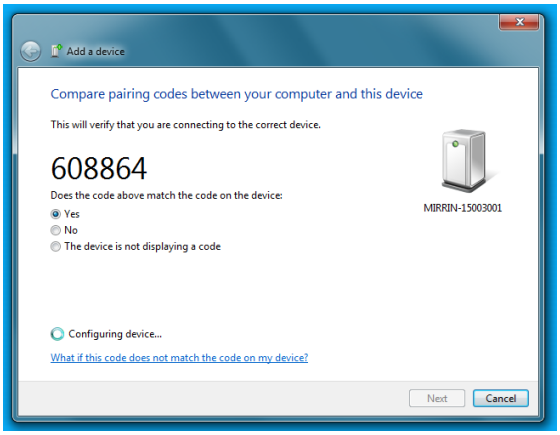


Figure 2.3.1.10

Step 7: Upon a successful pairing the window in figure 2.3.1.11 appears. Click the 'Close' button.

The device icon should now appear in the list of devices under the heading 'Devices and Printers' as shown in figure 2.3.1.12.

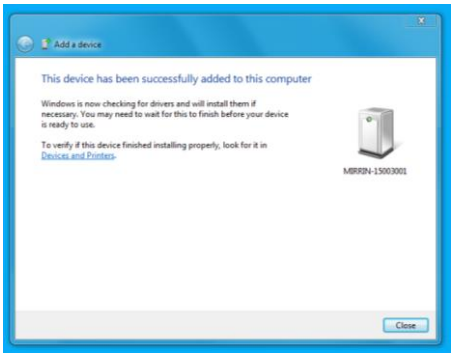


Figure 2.3.1.11

Figure 2.3.1.12

Step 8: Double click on the device icon and the window in figure 2.3.1.13 appears.

Step 9: Click on the hardware tab. The COM port assigned to this device (COM 17) is listed as shown in figure 2.3.1.14. Use this com port when connecting to this MLL using Bluetooth.

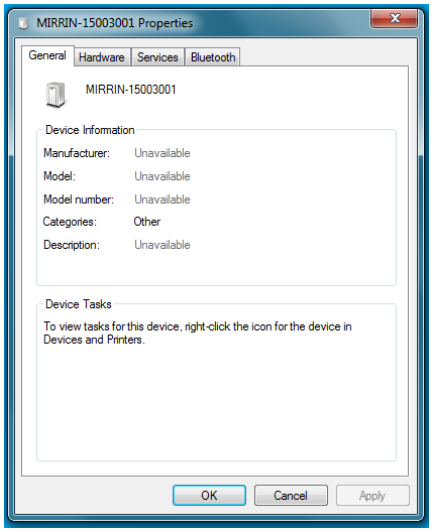


Figure 2.3.1.13

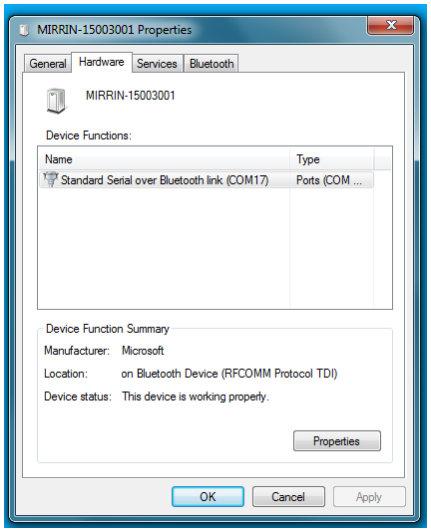


Figure 2.3.1.14

2.3.2 Establishing an access point for a WiFi enabled Mirrin

Step 1: Go to the start menu and click on the control panel icon shown in figure 2.3.2.1. The window in figure 2.3.2.2 appears.

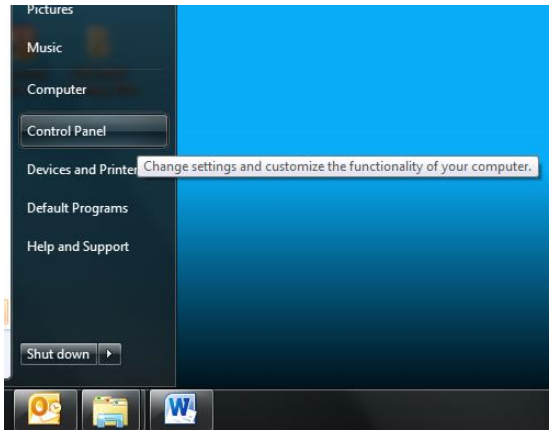


Figure 2.3.2.1

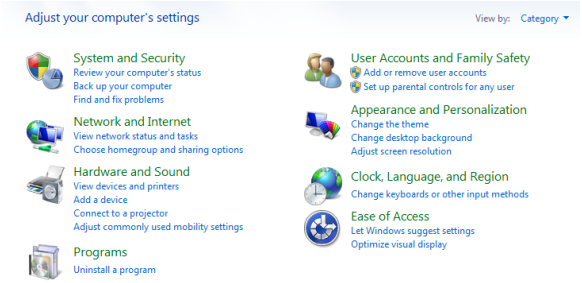


Figure 2.3.2.2

Step 2: Click on 'Network and Internet' as shown in figure 2.3.2.3. The window in figure 2.3.2.4 appears.

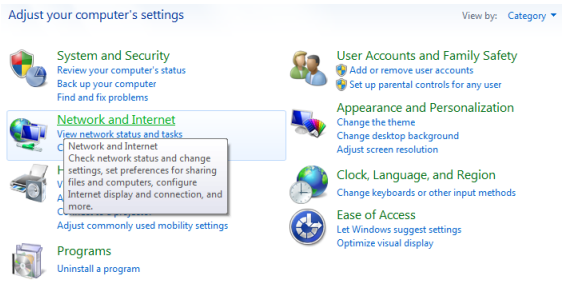


Figure 2.3.2.3

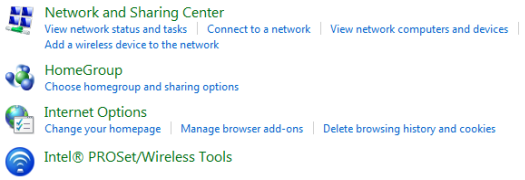


Figure 2.3.2.4

Step 3: Click on 'Network and Sharing Center' as shown in figure 2.3.2.4. The window in figure 2.3.2.5 appears.

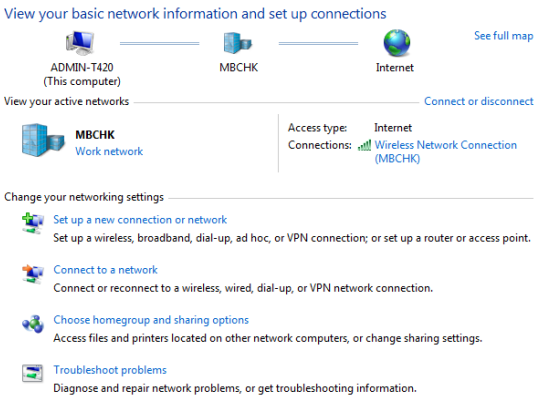


Figure 2.3.2.5

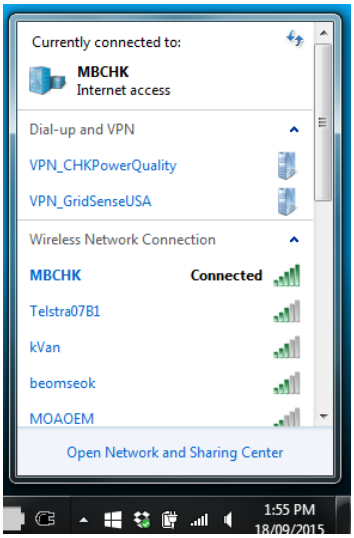


Figure 2.3.2.6

Step 4: Click on 'Connect to a Network' as shown in figure 2.3.2.5. The window in figure 2.3.2.6 appears.

Step 5: Press the button on the MLL to activate the WiFi wireless module and wait a few seconds. The window will update with the MLL showing the serial number as shown in figure 2.3.2.7.

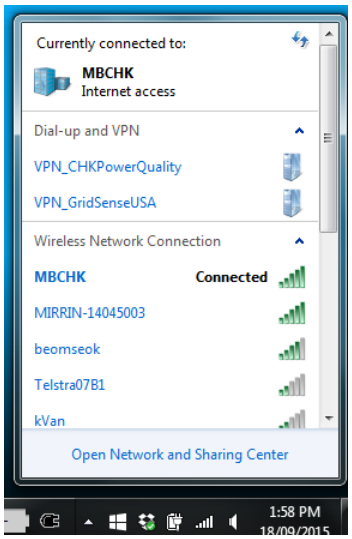


Figure 2.3.2.7

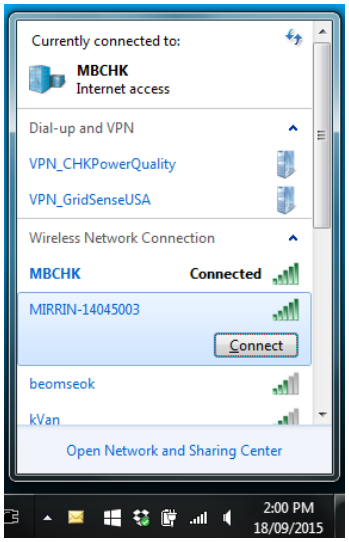


Figure 2.3.2.8

Step 6: Click on the MLL and the 'Connect' button will become visible.as shown in figure 2.3.2.8.

Step 7: Click on the 'Connect' button. The window shown in figure 2.3.2.9 appears. If successful, the MLL device will be connected as shown in figure 2.3.2.10.

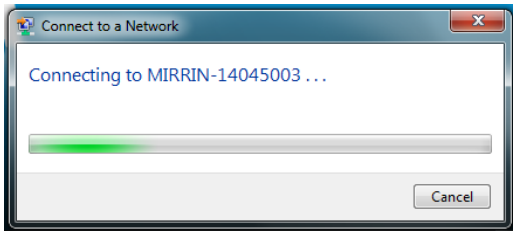


Figure 2.3.2.9

Figure 2.3.2.10

2.3.3 Connecting to the Mirrin

Step 1: Click on the Citrus icon in the start menu or double click on the Citrus icon on the desktop to launch the application. The application form shown in figure 2.3.3.1 will appear with available ports listed in the window on the left hand side.

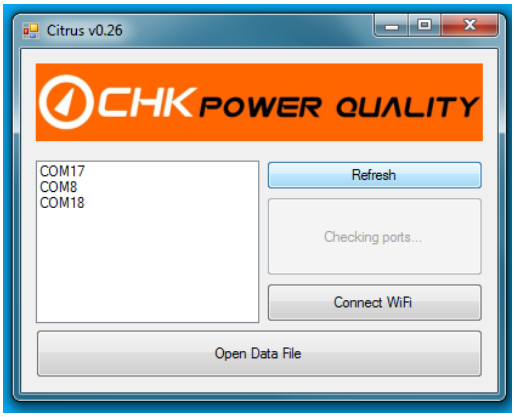


Figure 2.3.3.1

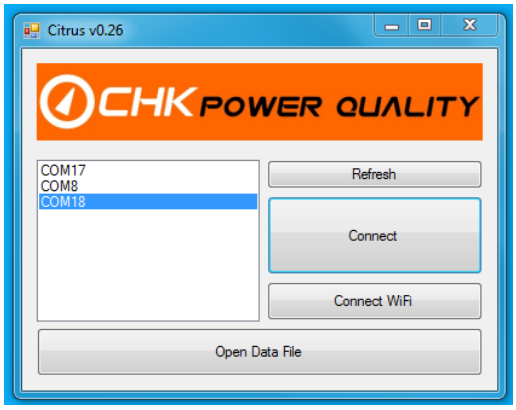


Figure 2.3.3.2

Note that the application is 'Checking ports'. Once completed the button text changes to 'Connect' and highlights the first port that can be opened as shown in figure 2.3.3.2. In this case it is COM18. The Refresh button scans for available ports and updates the list mentioned above.

Step 2: To connect using the serial cable or Bluetooth.

(a) Using the serial cable provided connect one end to a USB port on your PC and the other end to the port of the MLL.

(b) The serial cable is not required if using Bluetooth but ensure that the MLL's Bluetooth module is activated by pressing the button on the MLL.

Step 3: Click on the 'Connect' button. The 'Status' reading in the 'Status' window shown in figure 2.4.1 will appear as 'Status: Good' if the connection is successful. If the connection failed then a message box appears as shown in figure 2.3.3.3.

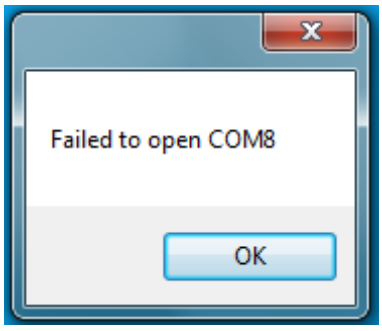


Figure 2.3.3.3

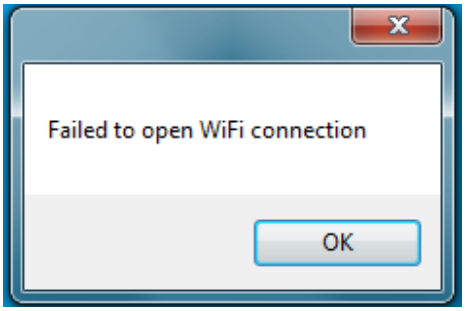


Figure 2.3.3.4

Step 4: To connect using WiFi.

The serial cable is not required if using WiFi but ensure that the MLL's WiFi module is activated by pressing the button on the MLL.

Step 5: Click on the 'Connect WiFi' button. The 'Status' reading in the 'Status' window shown in figure 2.4.1 will appear as 'Status: Good' if the connection is successful. If the connection failed then a message box appears as shown in figure 2.3.3.4.

2.4 Status Window

The status window provides useful information about the logger together with console buttons for managing the logger and its logged data.

Step 1: Click the 'Connect' button shown in figure 2.3.3.2. If communication is successful the status window will appear as shown in figures 2.4.1 and 2.4.2.

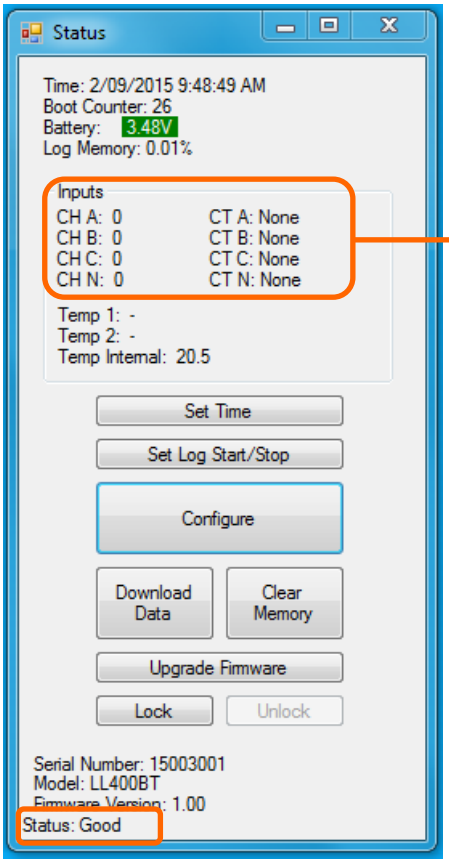


Figure 2.4.1
No sensors connected

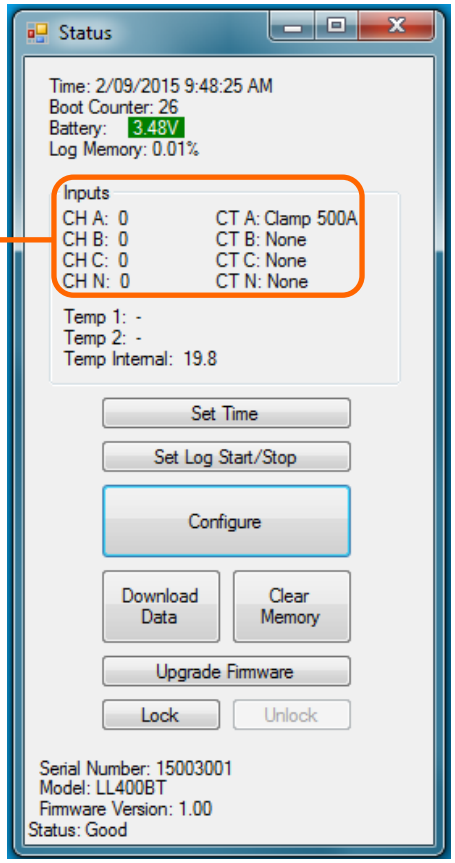


Figure 2.4.2
One sensor connected to channel A

2.4.1 Date and time

The date and time as shown in figure 2.4.1.1 is read from the logger's real time clock and updated every three seconds.

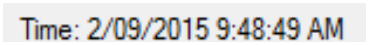


Figure 2.4.1.1

2.4.2 Boot counter

The 'Boot Counter' as shown in figure 2.4.2.1 essentially monitors the number of power-up cycles and is provided for diagnostic purposes.

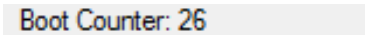


Figure 2.4.2.1

2.4.3 Battery indicator

The battery voltage level is monitored and displayed as shown in figure 2.4.3.1. The background colour utilises a traffic light scheme as shown in figure 2.4.3.2 to provide an indication of battery health.

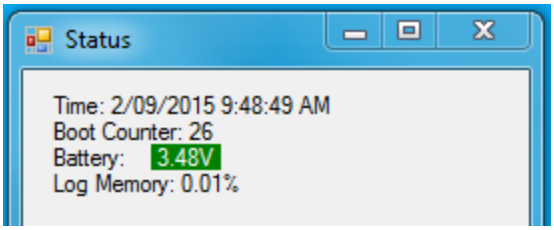


Figure 2.4.3.1

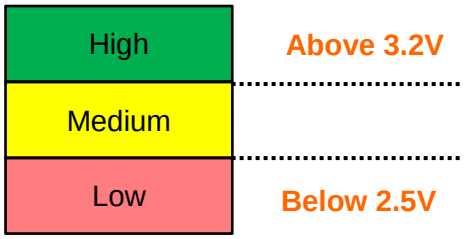


Figure 2.4.3.2

2.4.4 Log memory

'Log Memory' as shown in figure 2.4.4.1 displays the percent of memory utilised.

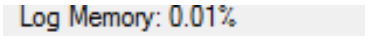


Figure 2.4.4.1

2.4.5 Inputs

Current: Displays the value of the load and the type of current sensor attached for each channel.

Temperature: Displays the temperature in Degrees Celsius for each channel. If the MLL does not support the optional temperature inputs the software will grey out the temperature channels and replace the value with "n/a".

2.4.6 Serial number

The 'Serial Number' is a unique number that identifies the device.

2.4.7 Model

The 'Model' number varies according to the installed hardware features. See table below.

Model Type	Model Number	Model Type	Model Number
Standard	LL400	**Temperature**	LL400T
Bluetooth	LL400B	**Bluetooth / Temperature**	LL400BT
WiFi	LL400W	**WiFi / Temperature**	LL400WT

2.4.8 Firmware

The 'Firmware Version' is the current version of code loaded in the logger.

2.4.9 Status

The 'Status' describes the functional state of the logger.

2.5 Set time

Clicking the 'Set Time' button sets the logger time to the PC time. An illustration of the times before and after the set is shown in figures 2.5.1 and 2.5.2.

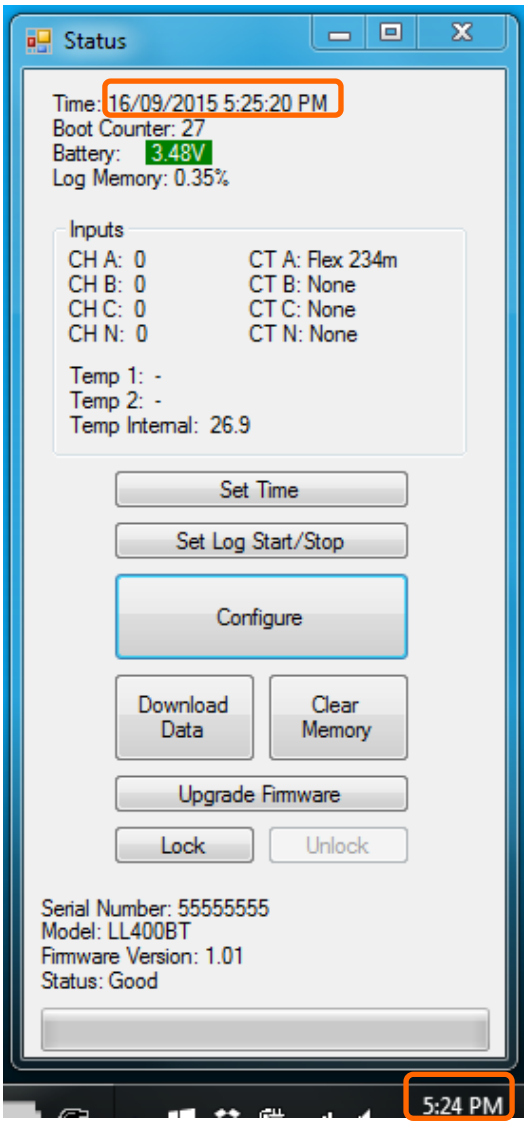


Figure 2.5.1

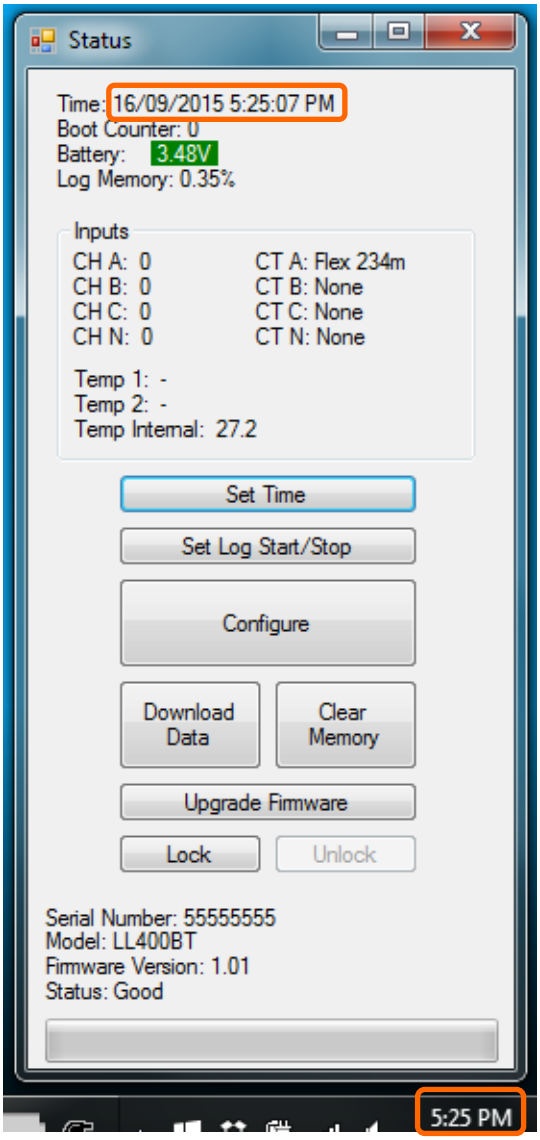


Figure 2.5.2

2.6 Set log start / stop

Step 1: Clicking the 'Set Log Start/Stop' button on the 'Status' window opens the window shown in figure 2.6.1 allowing the user to enter start and stop dates and times.

Step 2: To enable this feature, check (tick) the 'Restrict Logging Time' button as shown in figure 2.6.2.

The Start/Stop date-times are cleared automatically when the memory is cleared.

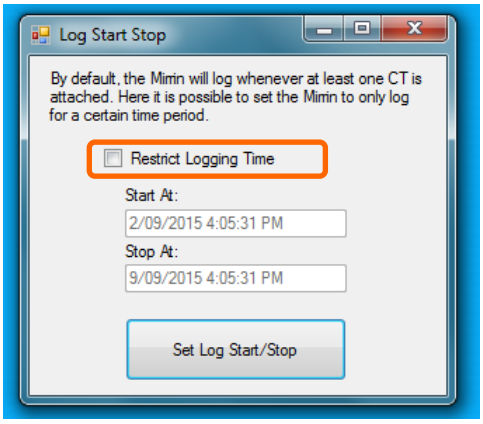


Figure 2.6.1

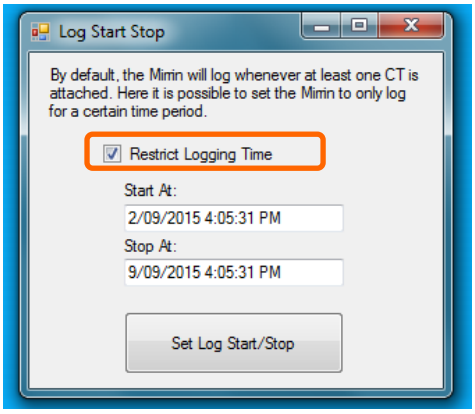


Figure 2.6.2

Step 3: Click on the 'Set Log Start/Stop' button to set (load) the start and stop times.

2.7 Configuration

Clicking the 'Configure' button on the 'Status' window opens the 'Configuration' window shown in figure 2.7.1 which displays the current configuration parameters stored in the logger.

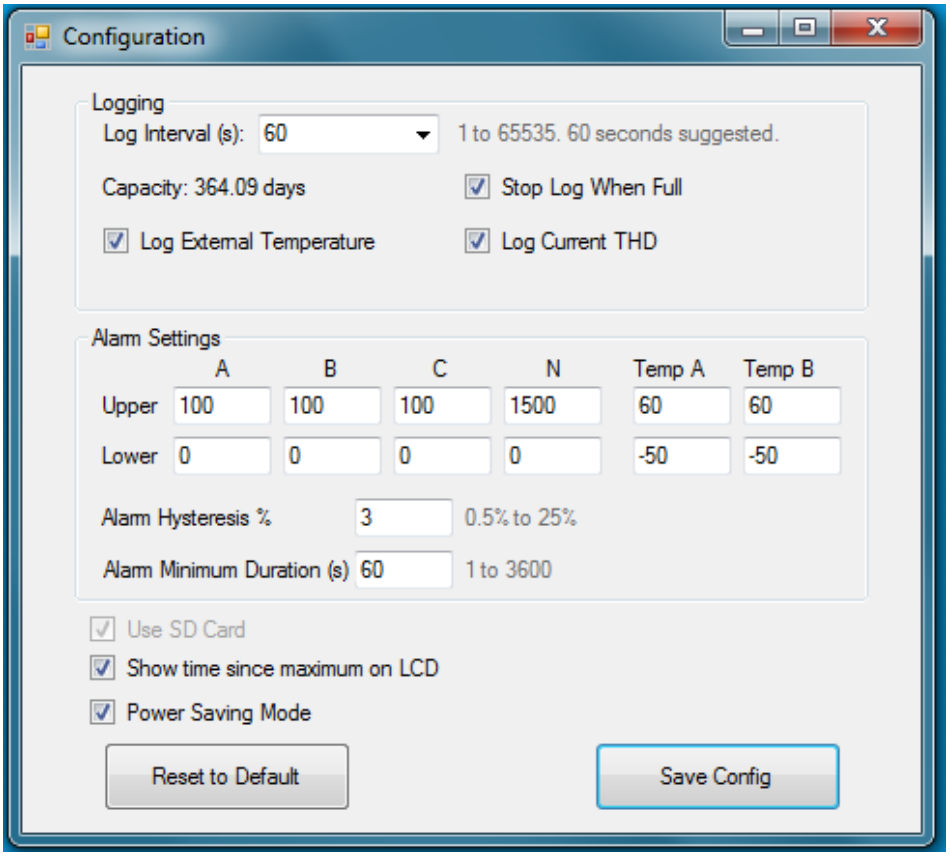


Figure 2.7.1

2.7.1 Log interval

The 'Log Interval' is settable from 1 second to 65535 seconds. The user is able to click in the cell and alter the value or click on the arrow to expand the drop down box as shown in figure 2.7.1.1 which provides some preferred options.

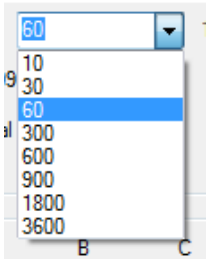


Figure 2.7.1.1

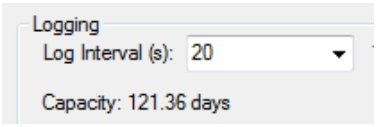


Figure 2.7.1.2

As the log interval changes the 'Capacity' also changes to reflect the available memory usage in days. The user can observe the 'Capacity' vary as the value of the 'Log Interval' is altered as shown in figure 2.7.1.2.

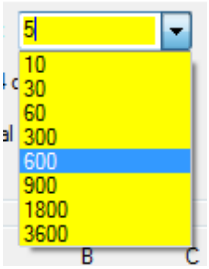


Figure 2.7.1.3

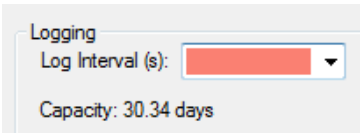


Figure 2.7.1.4

The background colour of the 'Log Interval' cell changes as follows:

Yellow: values are outside the preferred values; and
Red: values are not allowed.

The above is illustrated with figure 2.7.1.3 and 2.7.1.4.

2.7.2 Memory fill options

The function of the 'Stop Log when Full' checkbox.

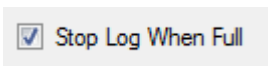


Figure 2.7.2.1

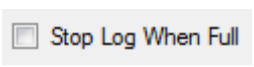


Figure 2.7.2.2

Checked (ticked) as shown in figure 2.7.2.1: The logger will stop logging when memory is full.

Unchecked (unticked) as shown in figure 2.7.2.2: The memory will continue to wrap when full and overwrite the first logged data.

2.7.3 Total harmonic distortion (THD)

Checking (ticking) the 'Log Current THD' check box will enable the calculation and logging of THD.

2.7.4 Temperature channels

Checking (ticking) the 'Log External Temperature' check box will enable the logging of both temperature channels. This option is not available in models that do not support external temperature channels.

2.7.5 Alarm settings

The logger provides for setting 'Upper' and 'Lower' alarm limits together with 'Alarm Hysteresis %' and 'Alarm Minimum Duration'. Figures 2.7.5.1 and 2.7.5.2 depict the alarm operations.

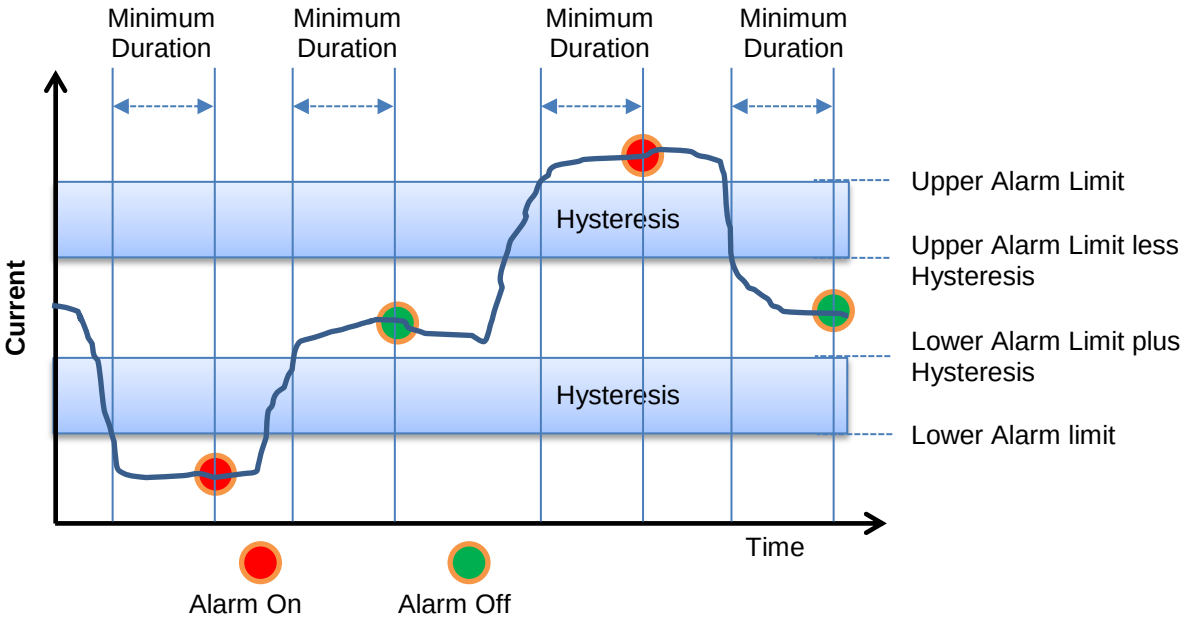


Figure 2.7.5.1

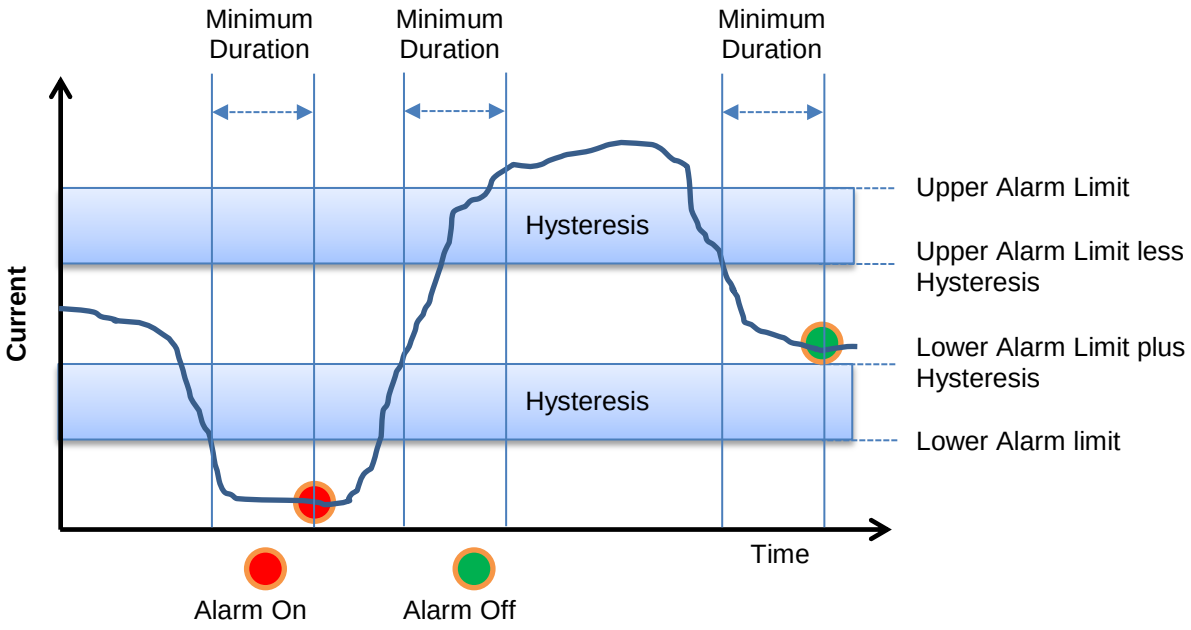


Figure 2.7.5.2

2.7.5.1 Upper and lower thresholds

The 'Upper' and 'Lower' magnitude threshold limits are shown in figure 2.7.5.1.1.

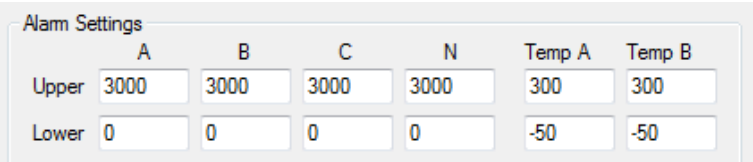


Figure 2.7.5.1.1

The background colour changes to red when the cell value is not allowed, as shown in figure 2.7.5.1.2.

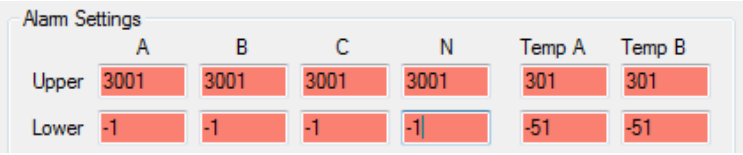


Figure 2.7.5.1.2

2.7.5.2 Hysteresis and minimum duration

The hysteresis level amount applies equally to the upper and lower limits. The minimum duration time applies equally for entering and existing alarm states.

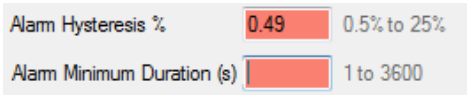


Figure 2.7.5.2.1

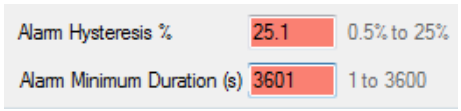


Figure 2.7.5.2.2

The background colour changes to red when the cell value is not allowed, as shown in figures 2.7.5.2.1 and 2.7.5.2.2.

2.7.6 Memory card

An SD Card is usually fitted to expand the base memory. If the unit is fitted with an SD card then the 'Use SD Card' check box will be ticked else remain unchecked. There is no option for the user to alter this setting.

2.7.7 Display time option for maximum value

The unit normally displays the maximum value with a time stamp of its occurrence. Checking the 'Show time since maximum on LCD check box will instead show the elapsed time from when the maximum current occurred (from the recorded maximum demand).

2.7.8 Power saving mode

Ticking the 'Power Saving Mode' reduces the normal sampling of four cycles per second to one cycle per second and hence extends internal battery life by up to three times longer.

2.7.9 Reset to default

Clicking the 'Reset to Default' button will load factory configuration settings as shown in figure 2.7.9.1.

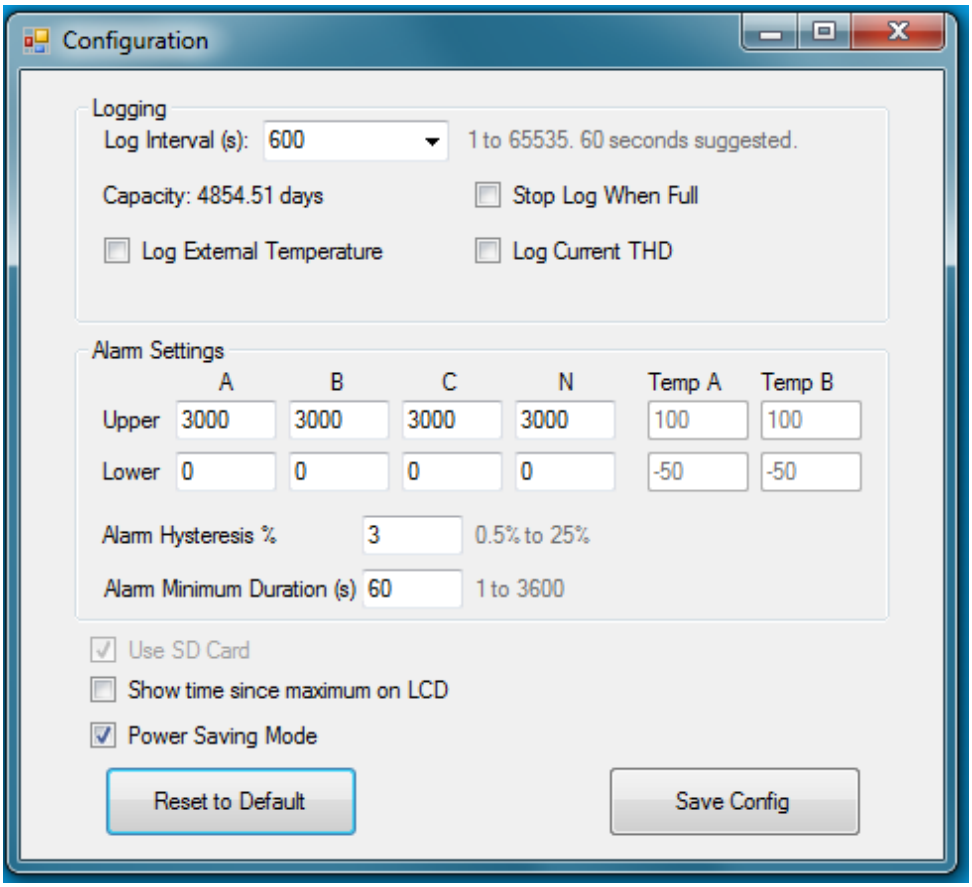


Figure 2.7.9.1

2.7.10 Save config

Clicking the 'Save Config' button commits the changes to the logger. A visual indication is shown in figure 2.7.10.1.

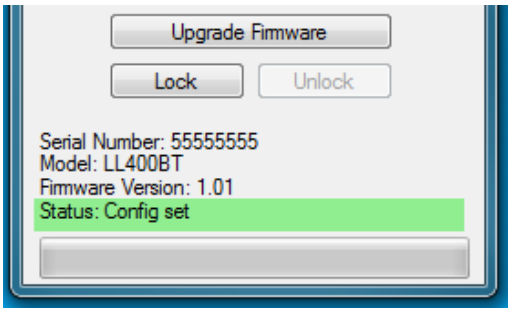


Figure 2.7.10.1

2.8 Upgrade firmware

Step 1: Click the 'Upgrade Firmware' button in the 'Status' window as shown in figure 2.8.1. A browsing window opens.

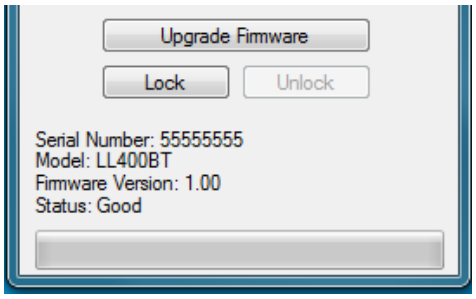


Figure 2.8.1

Step 2: Go to the folder containing the updated firmware file as shown in figure 2.8.2. Note the file has an extension of 'cfw'.

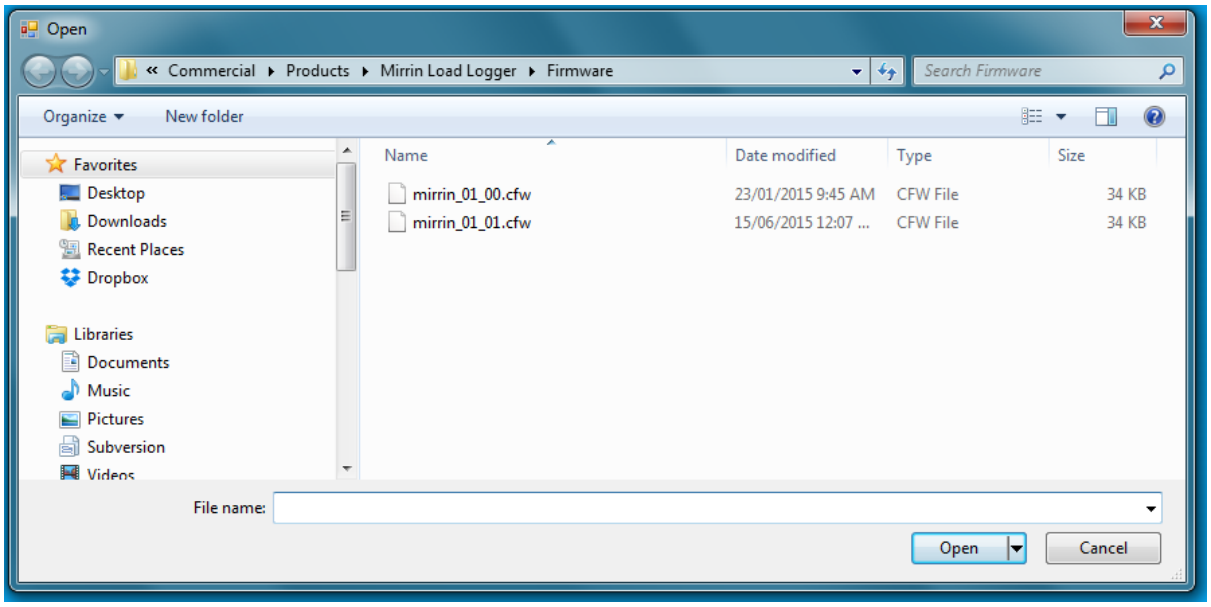


Figure 2.8.2

Step 3: Select the most recent file, in this example 'mirrin_01_01.cfw'. The selected file will appear in the 'File name' window as shown in figure 2.8.3.

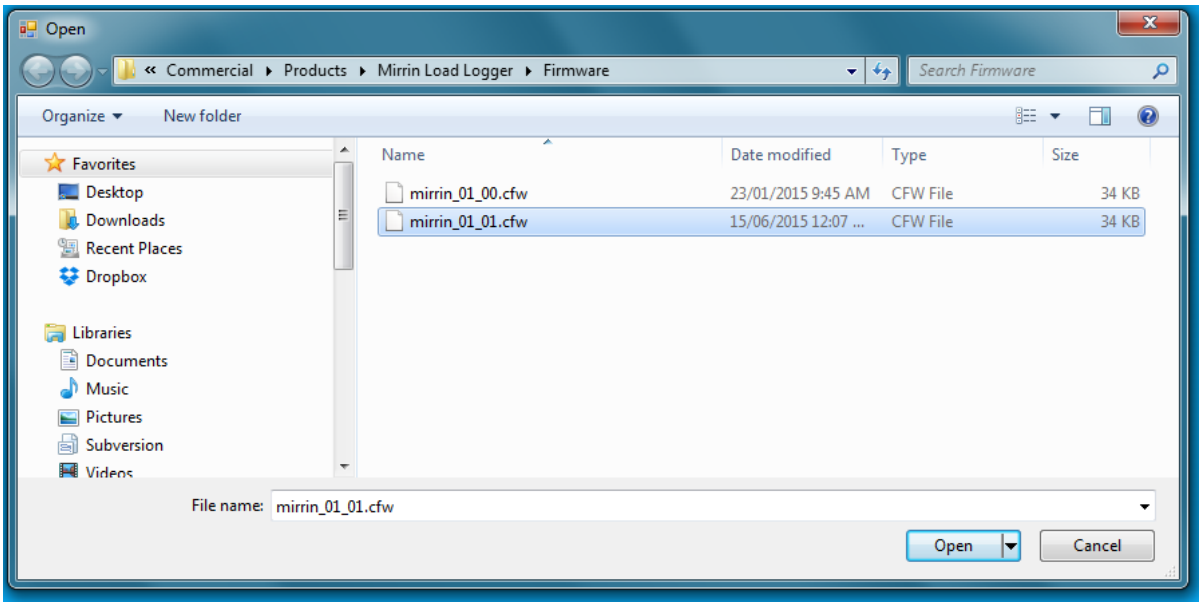


Figure 2.8.3

Step 4: Click the 'Open' button. A sequence of events will display on the 'status' screen as illustrated in figures 2.8.4 through to 2.8.7.

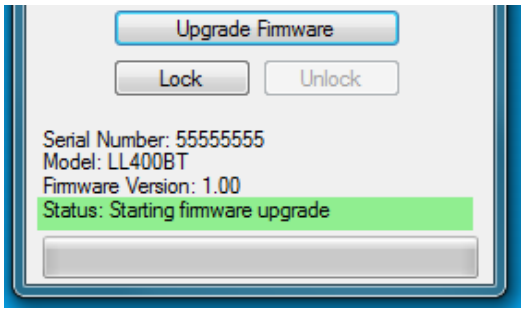


Figure 2.8.4

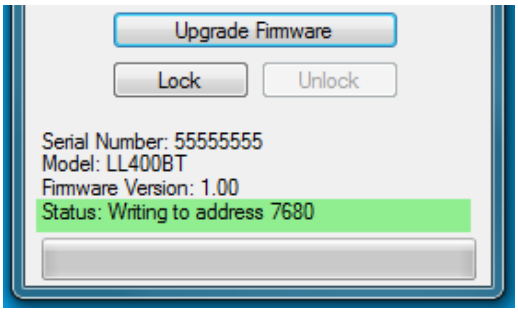


Figure 2.8.5

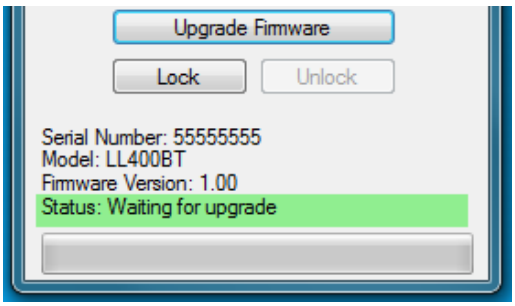


Figure 2.8.6

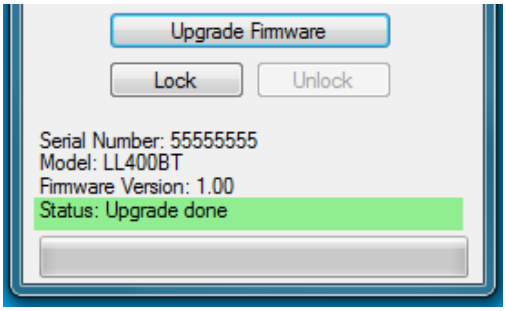


Figure 2.8.7

2.9 Downloading data

Step 1: Click the 'Download Data' button in the 'Status' window as shown in figure 2.9.1. A browsing window opens as shown in figure 2.9.2 that allows for downloading the logger file with a predefined file name in the format of 'Mirrin-Serial Number-Year-Month-Day_Hour-Minute-Second'.

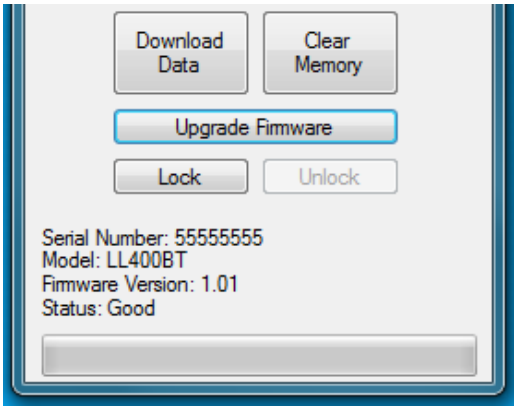


Figure 2.9.1

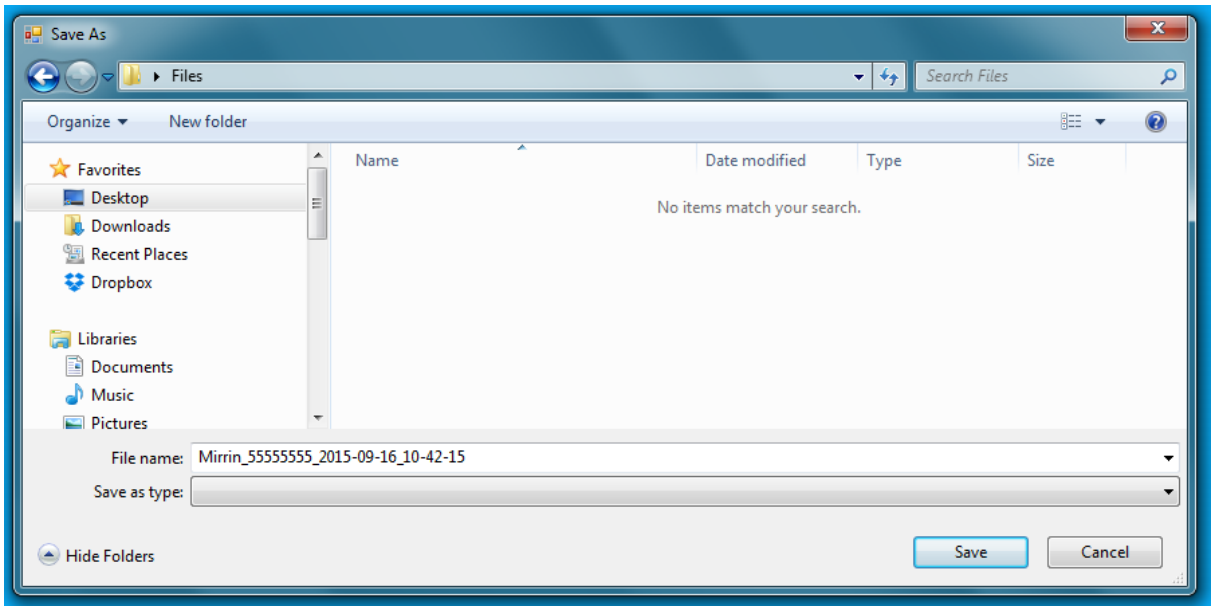


Figure 2.9.2

Step 2: Click on the 'Save' button. A sequence of events will display on the 'status' screen as illustrated in figures 2.9.3 through to 2.9.5.

Step 3: Click the 'Download Data' button again to verify that the file has been saved to the desired folder as shown in figure 2.9.6.

Step 4: Click the 'Cancel' button. The window in figure 2.9.6 closes.

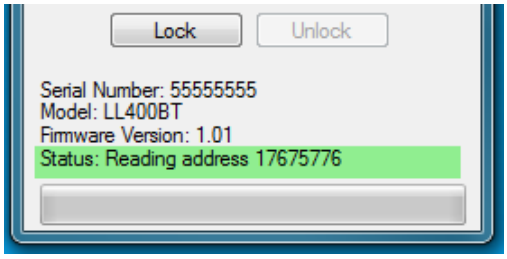


Figure 2.9.3

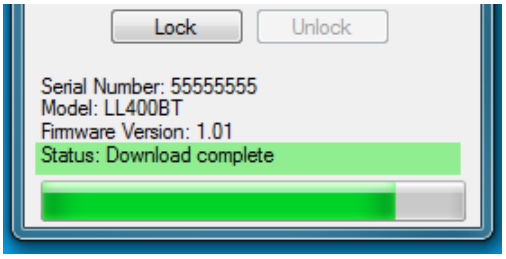


Figure 2.9.4

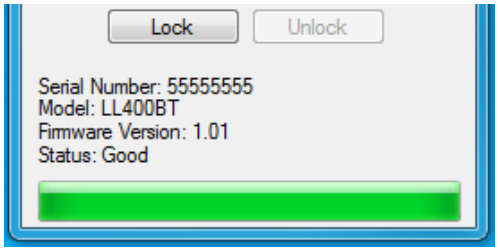


Figure 2.9.5

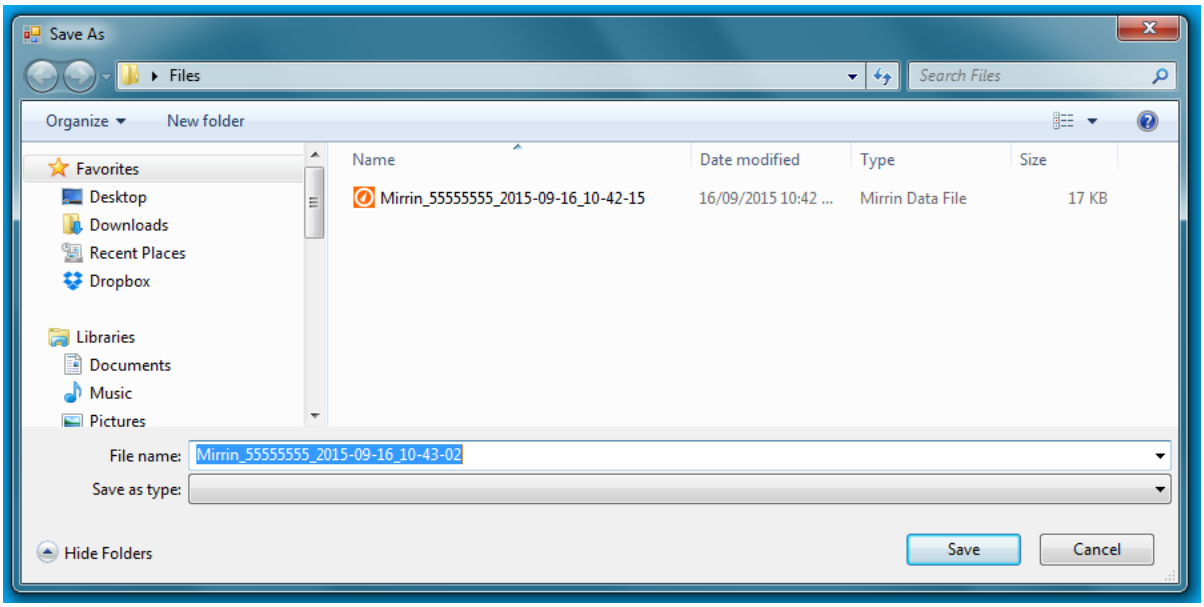


Figure 2.9.6

2.10 Clear memory

Step 1: Click on the 'Clear Memory' button in the 'Status' window as shown in figure 2.10.1. A message box as shown in figure 2.10.2 appears.

Step 2: Click on the 'Yes' button. Data is eliminated from the logger. A sequence of events will display on the 'status' screen as illustrated in figures 2.10.3 through to 2.10.4.

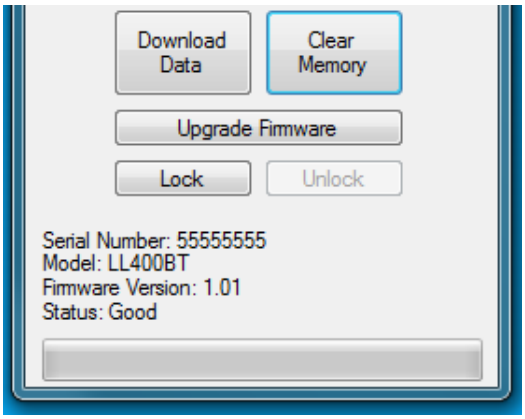


Figure 2.10.1

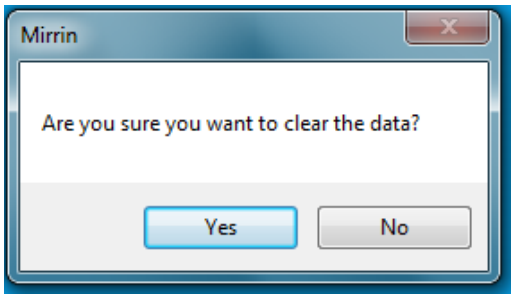


Figure 2.10.2

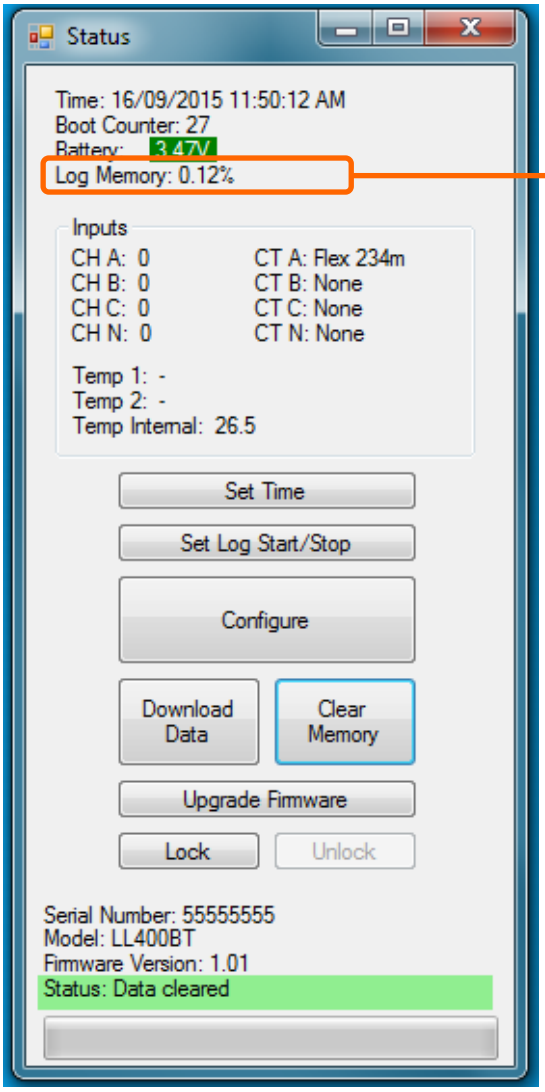


Figure 2.10.3

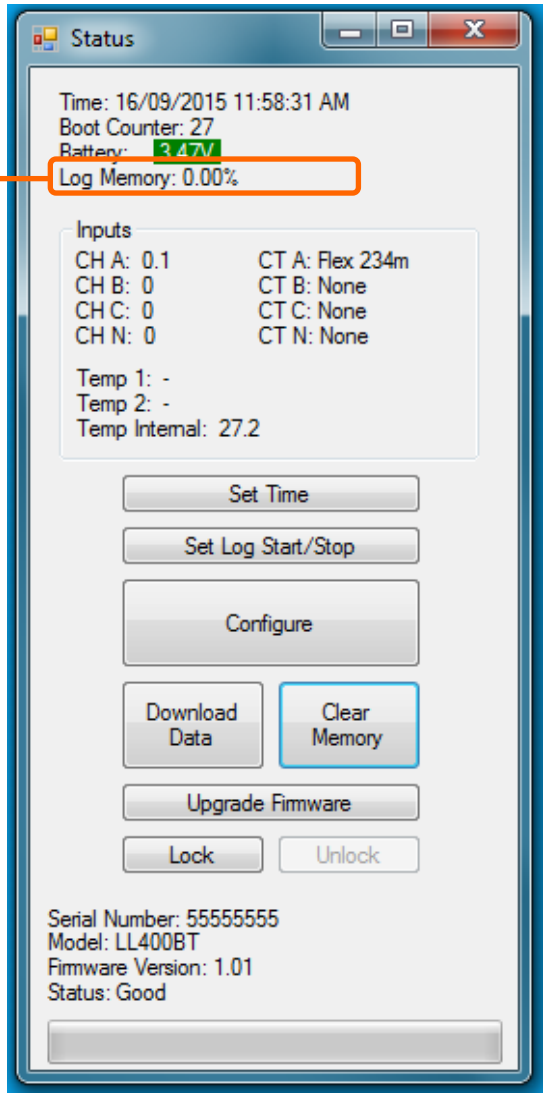


Figure 2.10.4

Note that the 'Log Memory' has been cleared.

2.11 Lock

This feature is intended to secure against unauthorised wireless access to the MLL.

Step 1: Click on the 'Lock' button in the 'Status' window as shown in figure 2.11.1. A message box as shown in figure 2.11.2 appears.

Step 2: Enter up to an eight digit number as the lock code in the input cell as shown in figure 2.11.2.

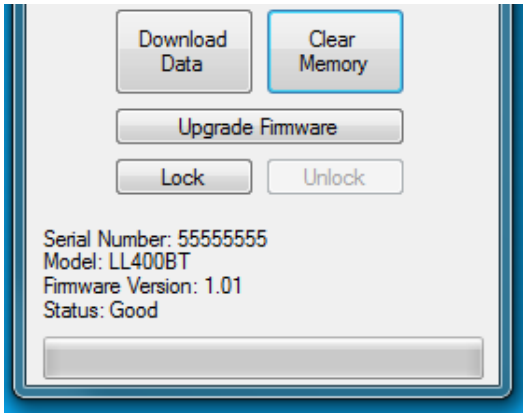


Figure 2.11.1

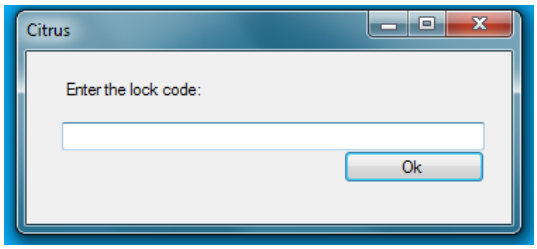


Figure 2.11.2

Step 3: Click on the 'Ok' button. The 'Status' window as shown in figure 2.11.3 is now protected.

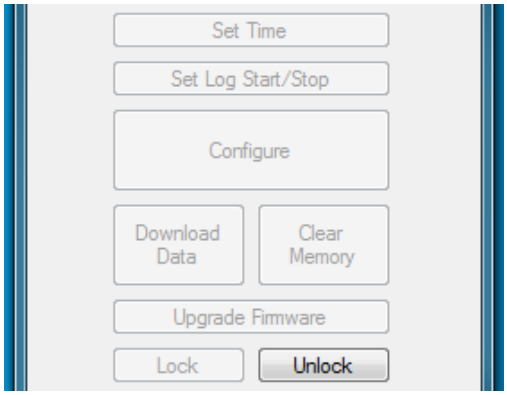


Figure 2.11.3

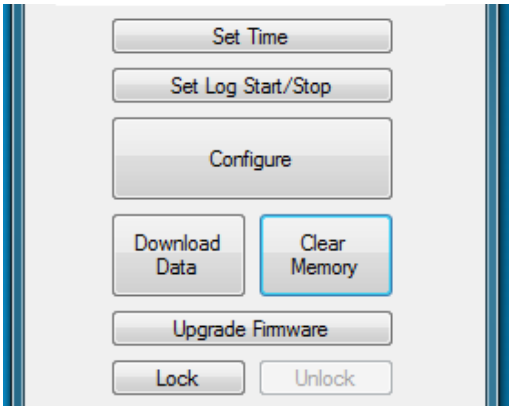


Figure 2.11.4

Step 4: Click on the 'Unlock' button, the window in figure 2.11.2 appears. Enter the lock code to unlock the device. The 'Status' window as shown in figure 2.11.4 is now unprotected.

2.12 Open data file

Step 1: Click on the 'Open Data File' button on the main 'Citrus' application menu shown in figure 2.12.1.

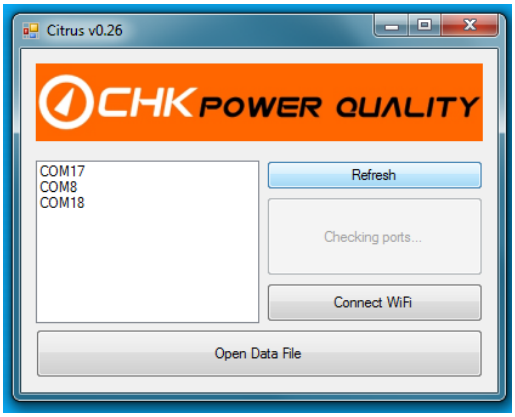


Figure 2.12.1

Step 2: A browsing window opens for locating a 'MLL file' as shown in figure 2.12.2.

Step 3: Select the desired 'MLL file' to open. The filename will appear next to 'File name' as shown in figure 2.12.3 and click on 'Open'.

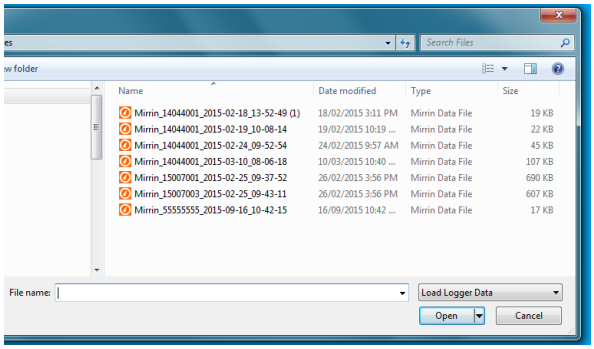


Figure 2.12.2

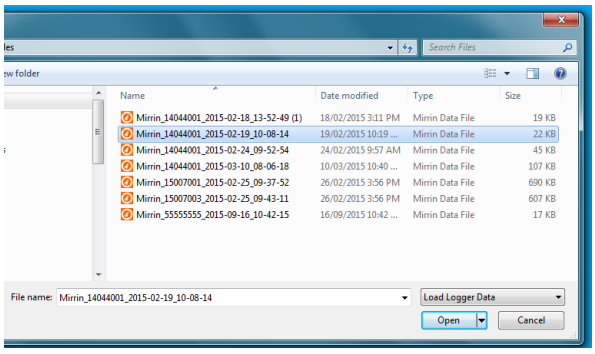


Figure 2.12.3

A graph appears as shown in figure 2.12.4 displaying four current channels together with external temperatures.

2.12.1 Active channels

All active channels able to be graphed are listed along the right hand side of the chart. In this case they include CH A, CH B, CH C, CH N, ATHD, BTHD, CTHD, NTHD, Temperature 1 and Temperature 2.

2.12.1.1 Additional active channels

Two additional channels, 'Temperature Internal' and 'Battery Voltage' become active when clicking the 'Show Diagnostics' button as shown in figure 2.12.1.1.1.

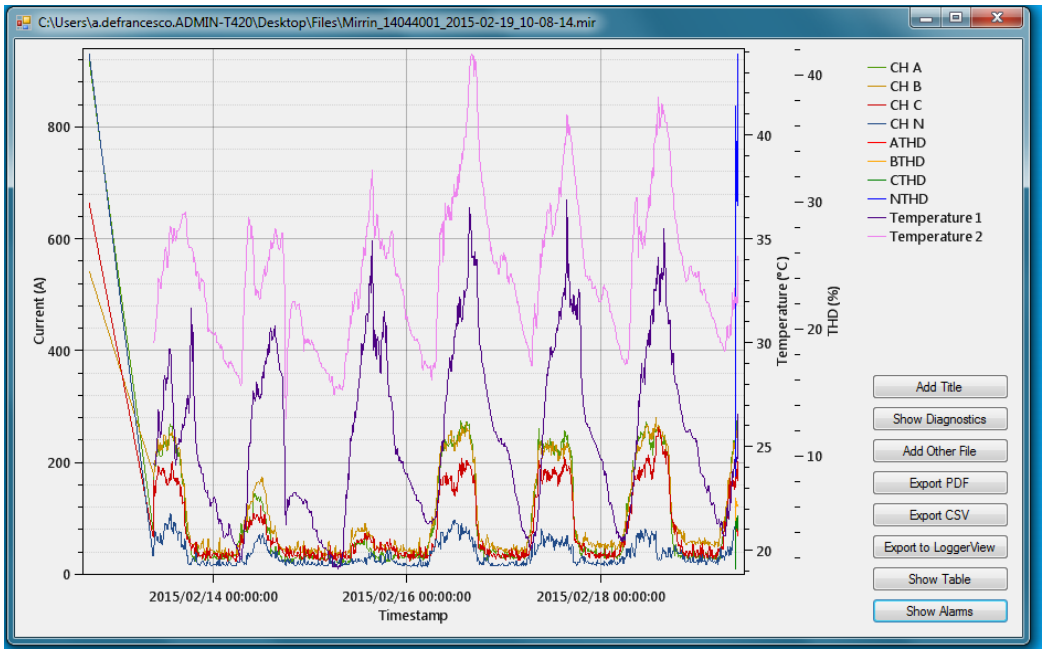


Figure 2.12.4

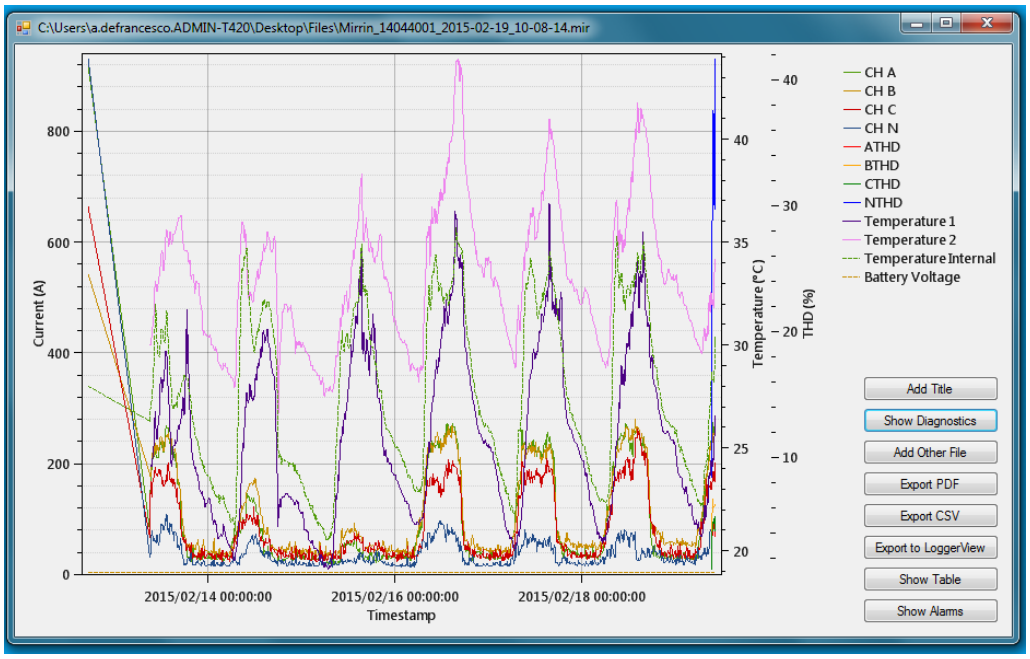


Figure 2.12.1.1.1

Toggling the 'Show Diagnostics' button effectively adds and removes these two channels which are primarily used for diagnostic purposes.

2.12.1.2 Trace selection

The user is able to remove or add any trace from the graph by alternatively clicking on the trace legend. The legend colour of deselected traces changes to a faint grey. See example shown in figure 2.12.1.2.1

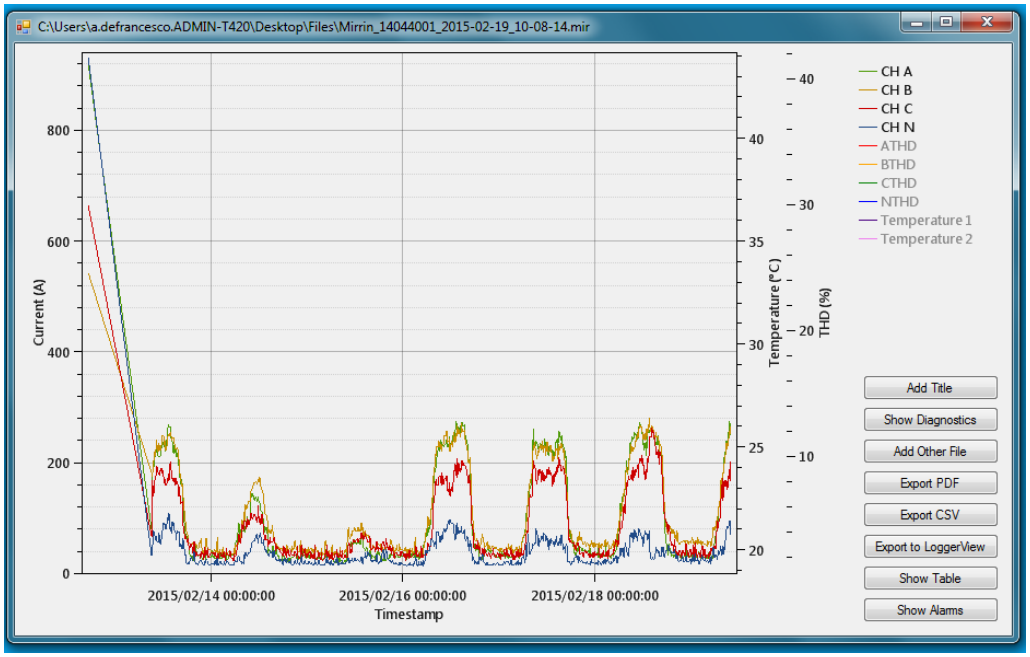


Figure 2.12.1.2.1

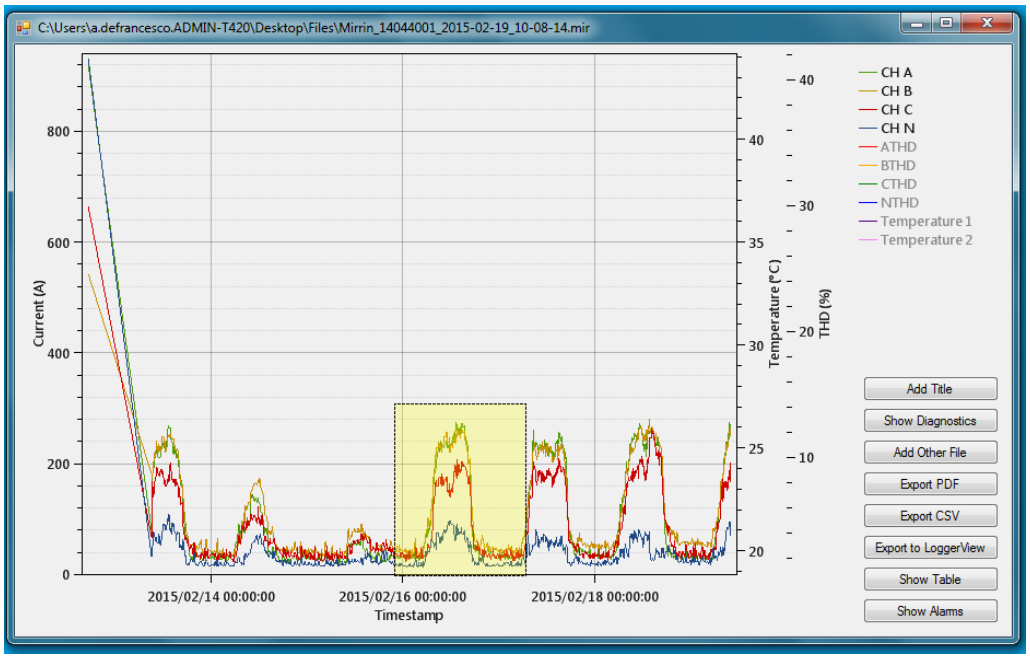


Figure 2.12.2.1

2.12.2 Adjusting scales

The user is able to alter the time and amplitude scales concurrently by selecting a portion of the graph. With the mouse the user is able to right click, hold, and drag it vertically and horizontally to generate a yellow highlighted box as shown in figure 2.12.2.1. The selected portion is expanded to fill the whole chart upon release of the right button as shown in figure 2.12.2.2. Another example is shown in figures 2.12.2.3 and 2.12.2.4.

Note: Double clicking in the chart area will reproduce the original chart using the full data range.

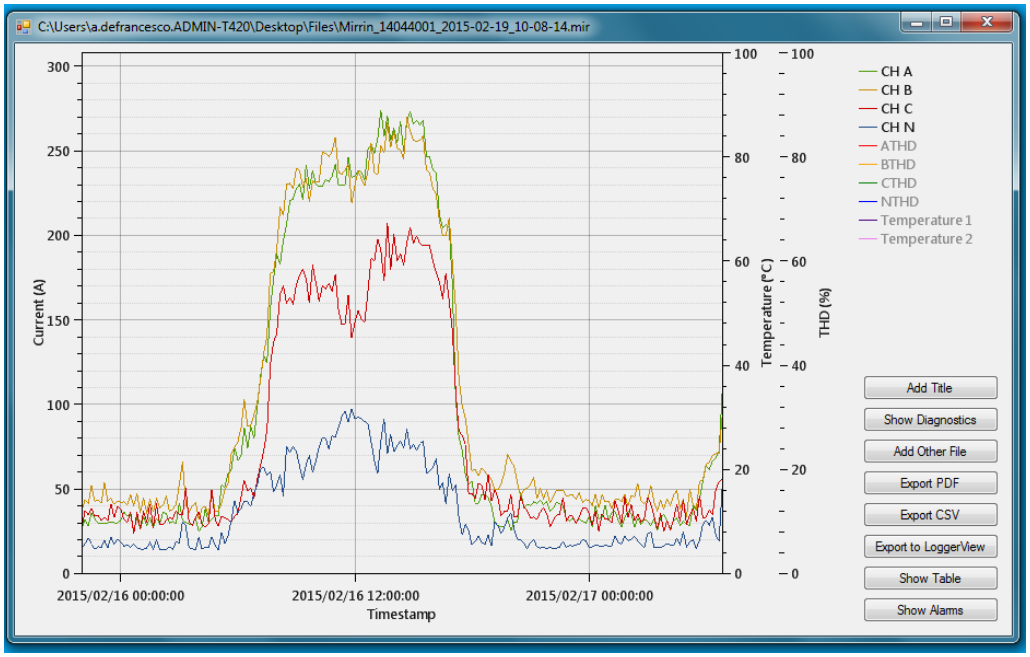


Figure 2.12.2.2

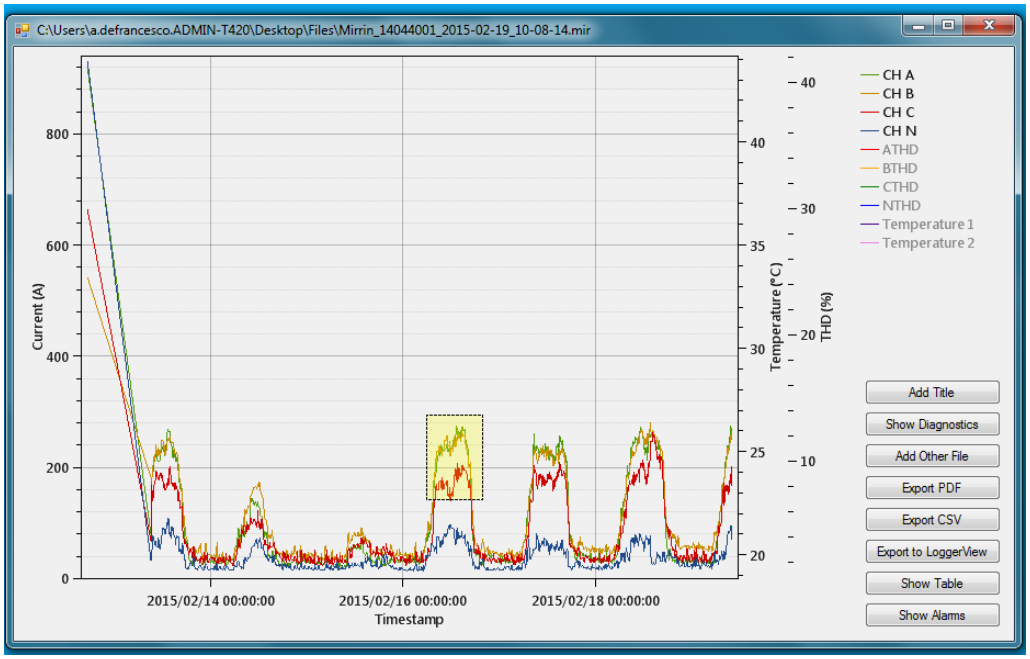


Figure 2.12.2.3

Figure 2.12.2.4

2.12.2.1 Moving axis

The user can select and move any amplitude axis by using the right hand side button on the mouse. Keeping this button pressed and hovering over the axis of interest the user can move (drag) the axis up or down. This is illustrated by moving the temperature axis down as shown in figures 2.12.2.1.1 and 2.12.2.1.2.

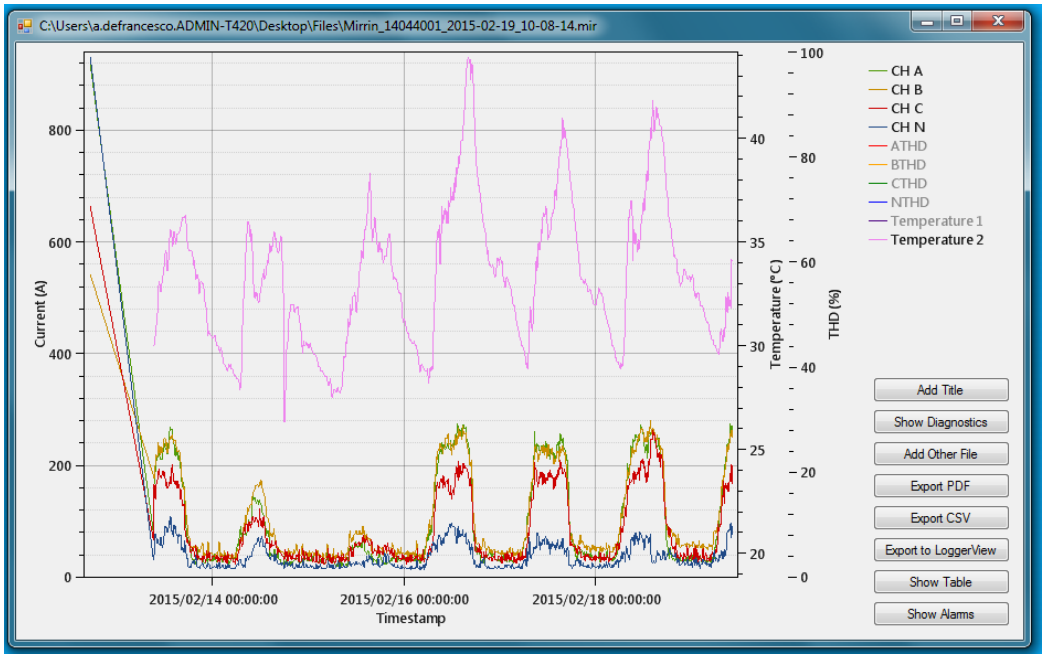


Figure 2.12.2.1.1

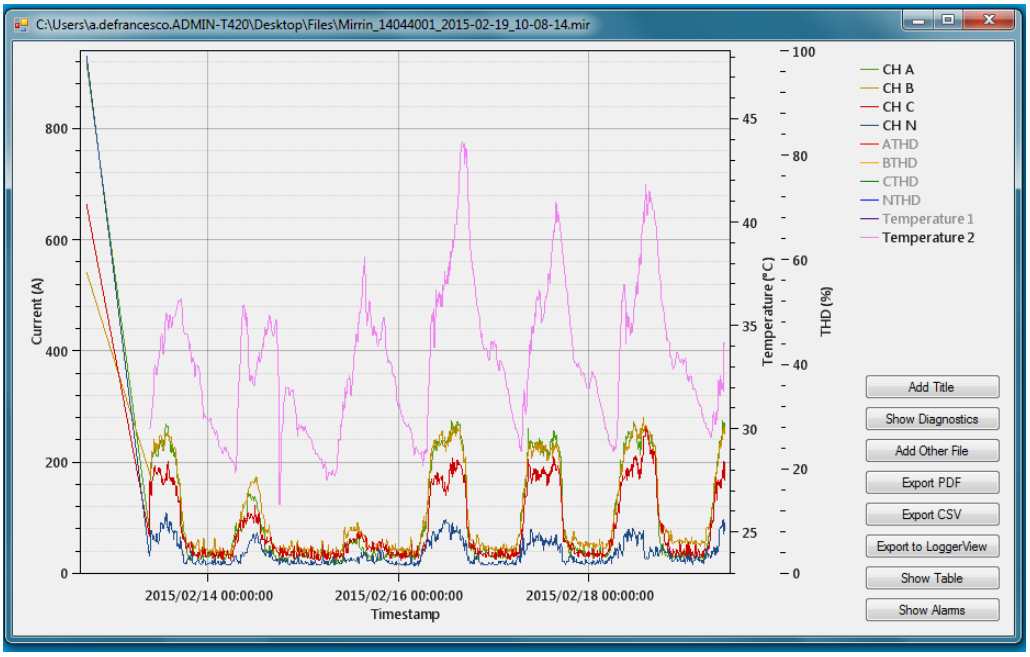


Figure 2.12.2.1.2

2.12.2.2 Changing axis range

The user can change the range of any axis. Using the centre wheel of the mouse the user can increase or decrease the range by moving the wheel up or down respectively. Figures 2.12.2.2.1 and 2.12.2.2.2 show that the ranges for the temperature and time axis have been respectively altered.

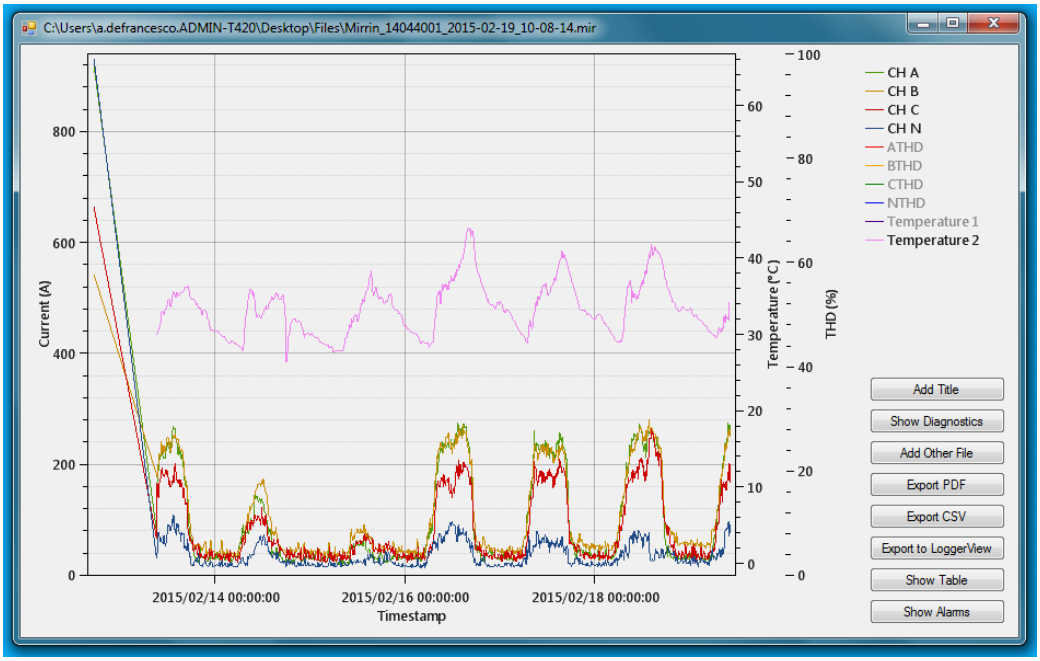


Figure 2.12.2.2.1

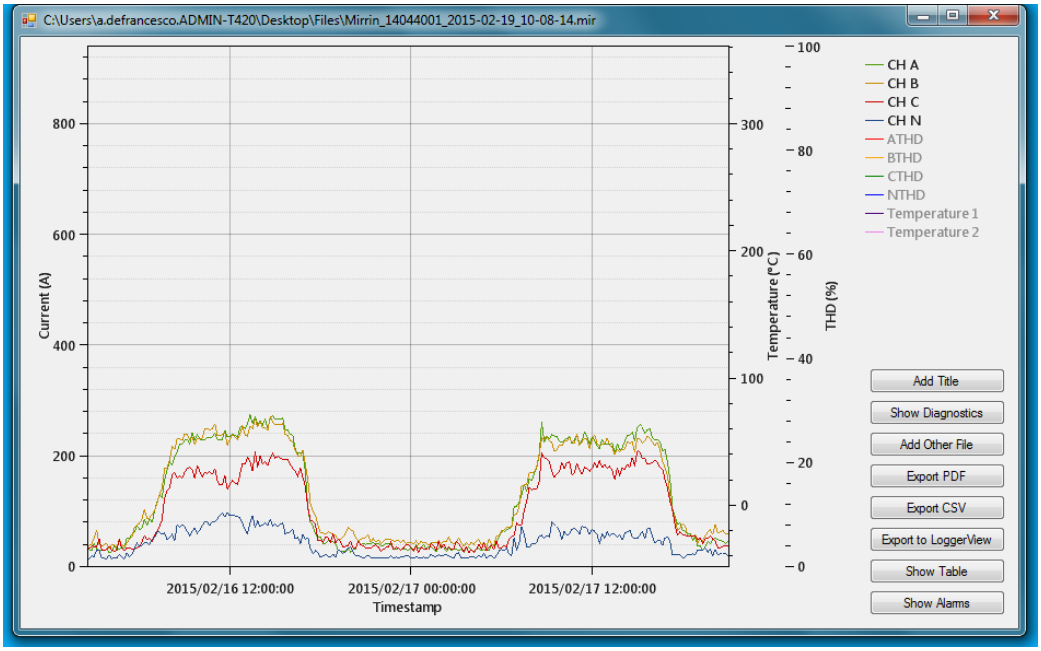


Figure 2.12.2.2.2

2.12.2.3 Zooming

The user can zoom in and out using the centre wheel of the mouse. Hover inside the chart area and over the portion of the chart which you desire to zoom. The user can increase or decrease the zoom by moving the wheel up or down respectively. Figures 2.12.2.3.2 and 2.12.2.3.3 show zoom-in and zoom-out with respect to figure 2.12.2.3.1.

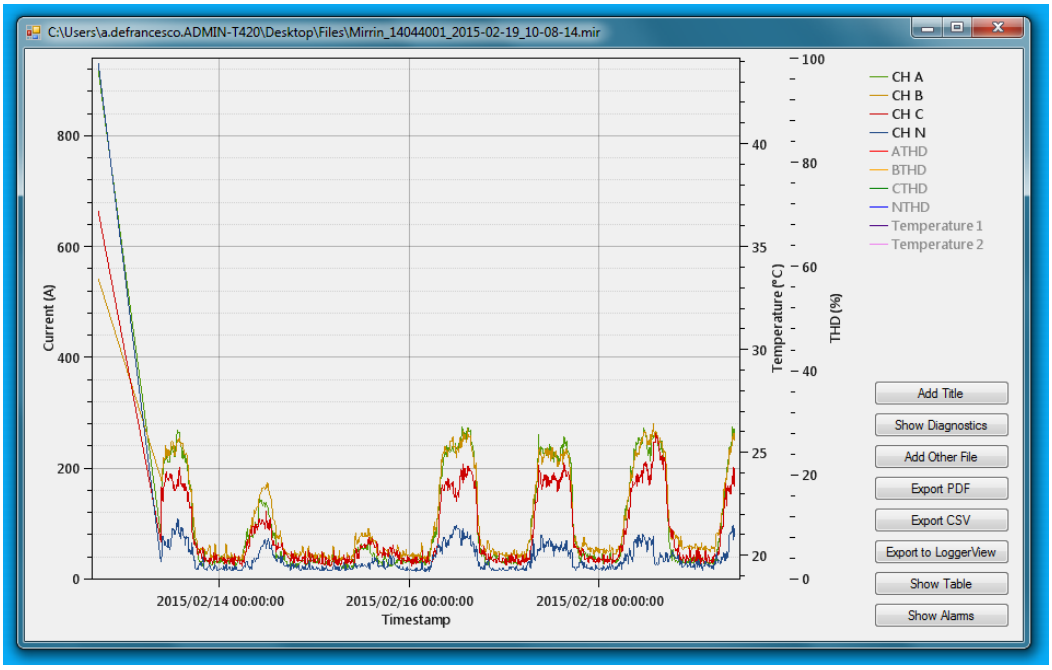


Figure 2.12.2.3.1

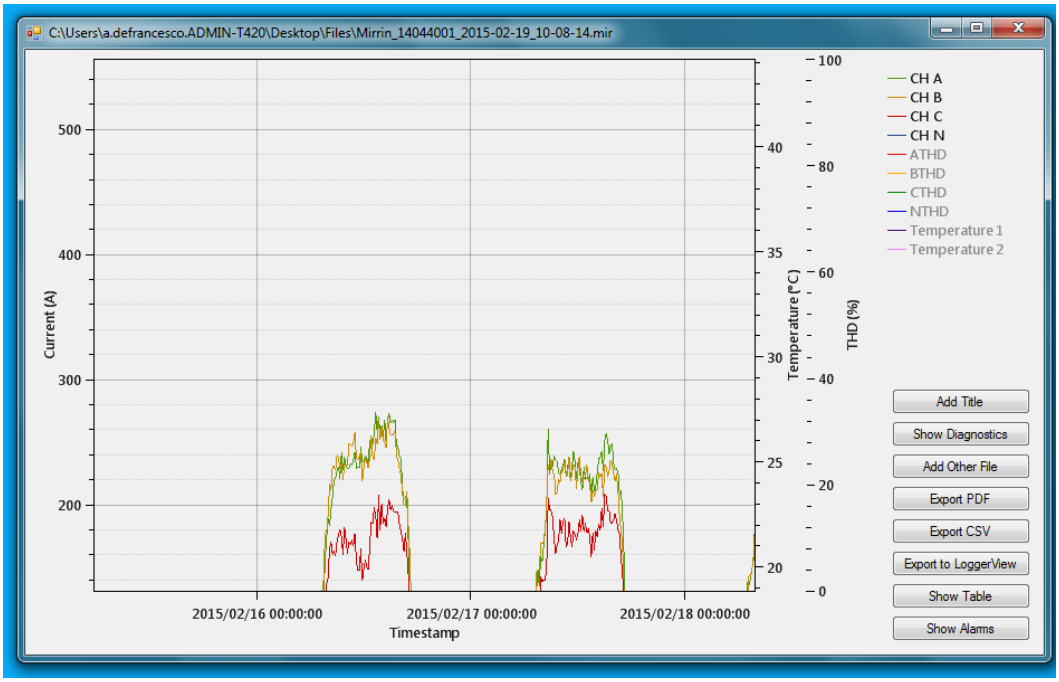


Figure 2.12.2.3.2

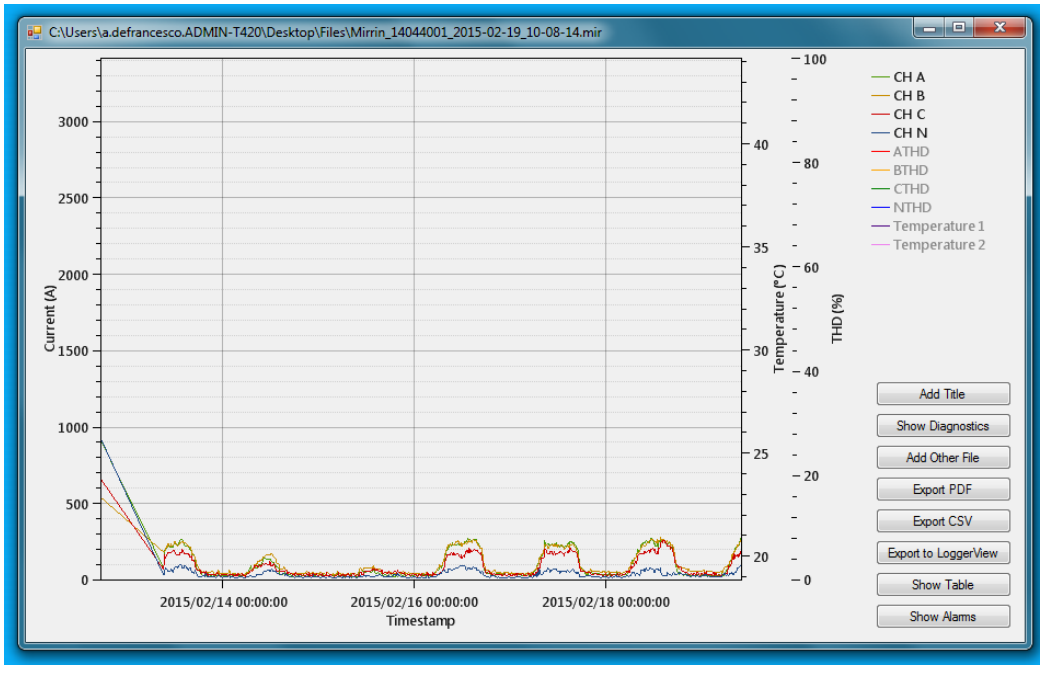


Figure 2.12.2.3.3

2.12.3 Title

Step 1: Click on the 'Add Title' button. A window opens as shown in figure 2.12.3.1.

Step 2: Enter a description as shown in figure 2.12.3.2.and then click the 'Ok' button. The chart is now updated with a title as shown in figure 2.12.3.3

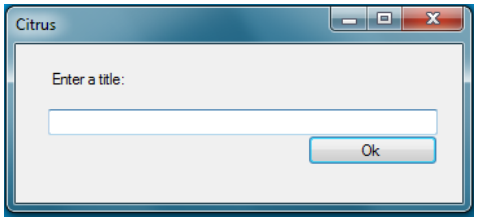


Figure 2.12.3.1

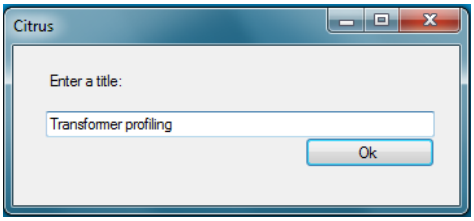


Figure 2.12.3.2

Repeat step 1 to remove the title, but enter nothing.

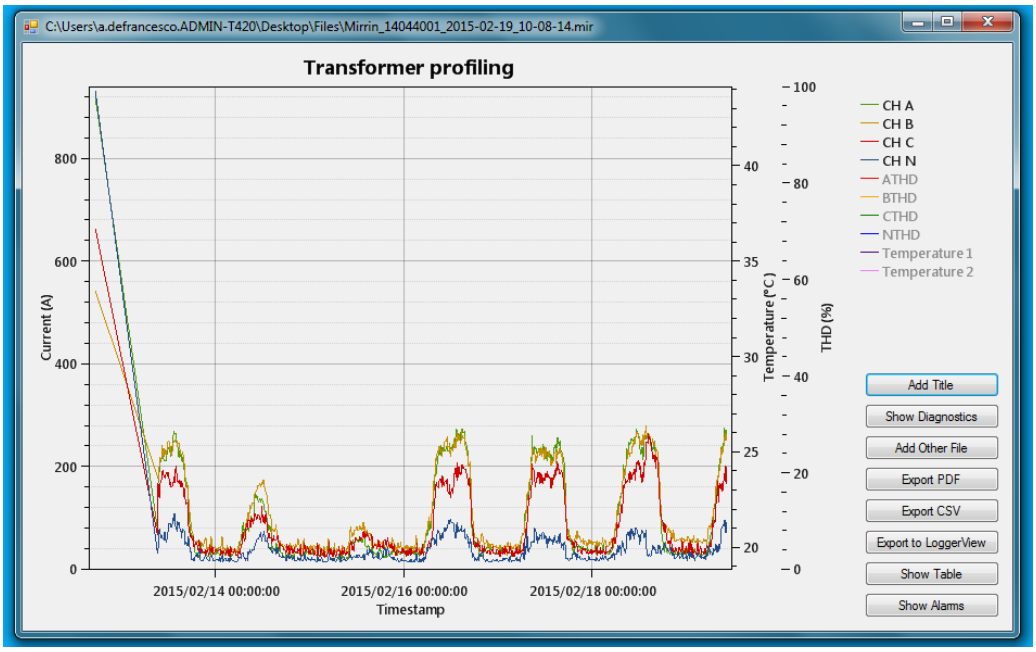


Figure 2.12.3.3

2.12.4 Generate a PDF

Step 1: Click on the 'Export PDF' button. A browsing window opens as shown in figure 2.12.4.1.

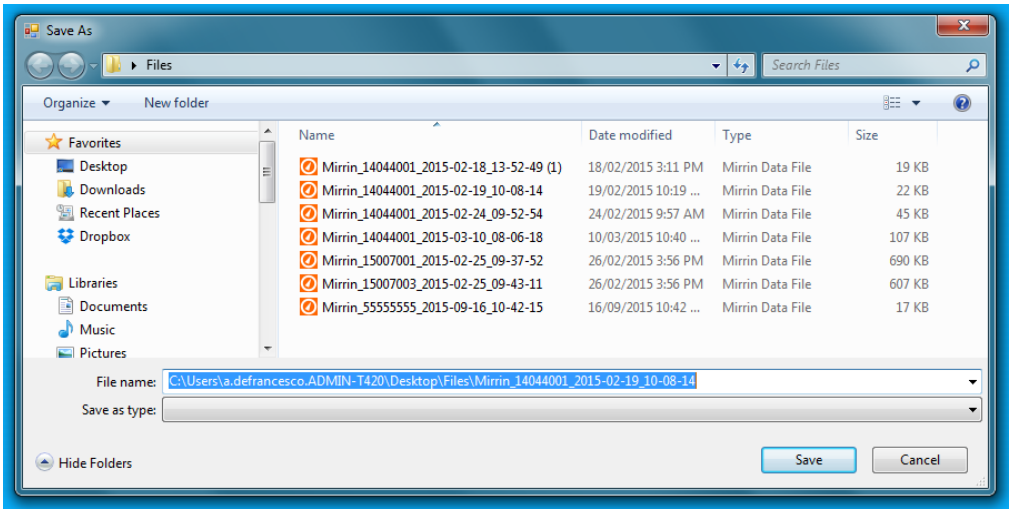


Figure 2.12.4.1

Step 2: Click on the 'Save' button. The window closes.

Step 3: Again, click on the 'Export PDF' button. A browsing window opens as shown in figure 2.12.4.2. Note that the folder now also includes the recently saved PDF.

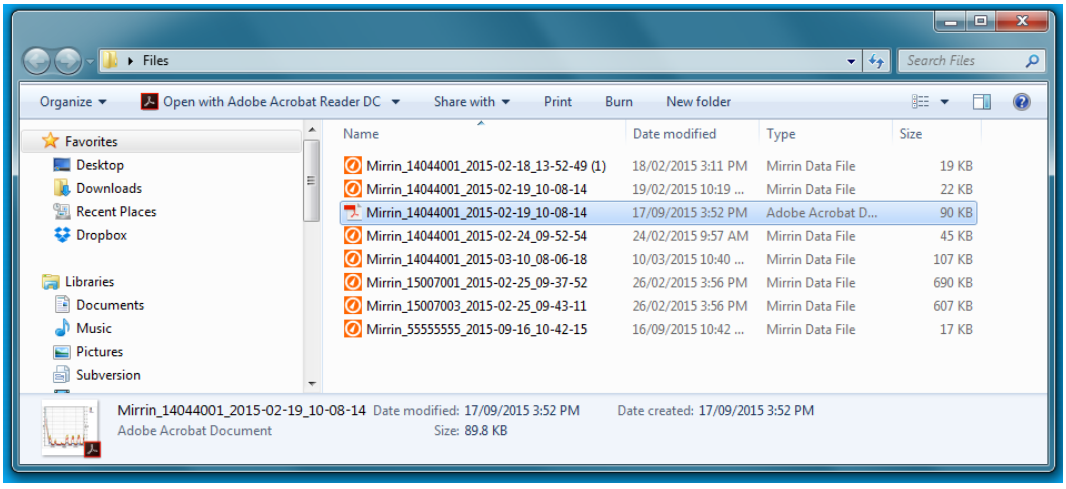


Figure 2.12.4.2

Step 4: Double click on the 'PDF' as shown in figure 2.12.4.2. The PDF is shown in figure 2.12.4.3.

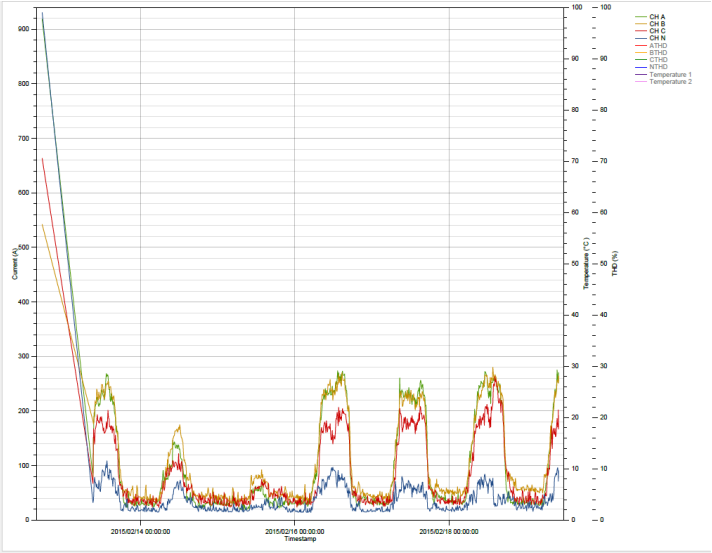


Figure 2.12.4.3

2.12.5 Export CSV

Step 1: Click on the 'Export CSV' button. A browsing window opens as shown in figure 2.12.5.1.

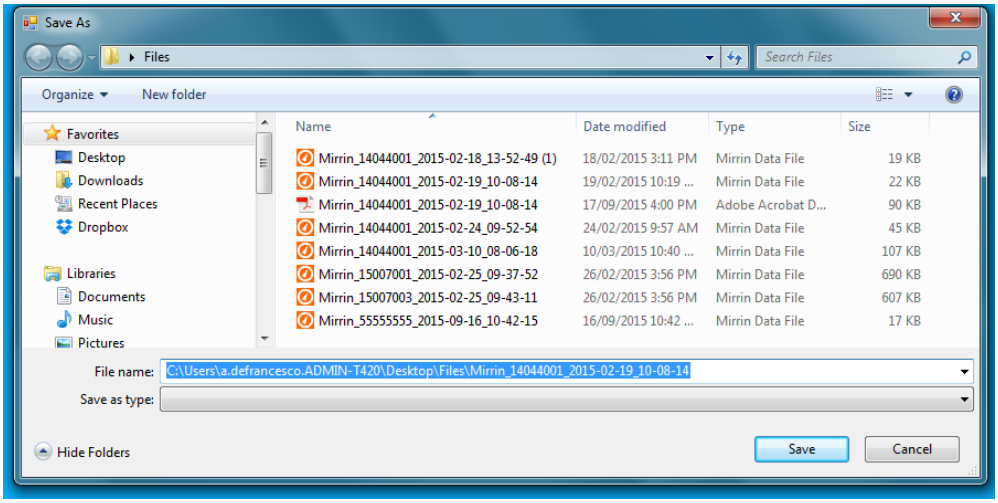


Figure 2.12.5.1

Step 2: Click on the 'Save' button. The window closes.

Step 3: Again, click on the 'Export CSV' button. A browsing window opens as shown in figure 2.12.5.2. Note that the folder now also includes two CSV files, one for data and other for alarms.

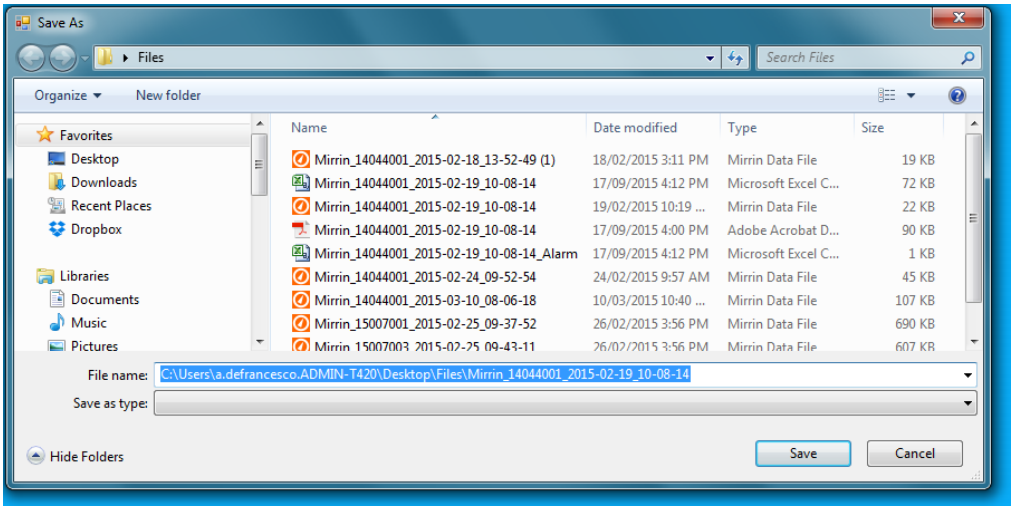


Figure 2.12.5.2

2.12.6 Export to LoggerView

Step 1: Click on the 'Export to LoggerView' button. A message window popup appears as shown in figure 2.12.6.1.

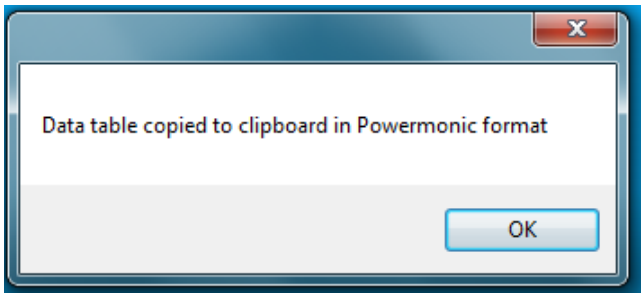
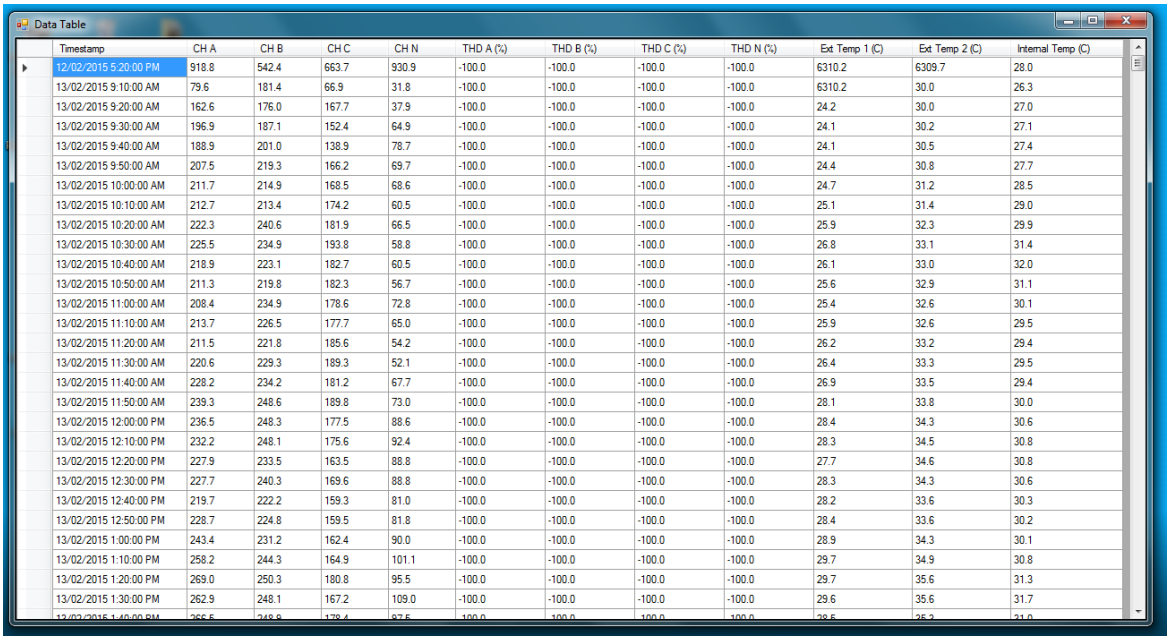


Figure 2.12.6.1

2.12.7 Show table

Step 1: Click on the 'Show Table' button. A list of logged values is displayed in a table as shown in figure 2.12.7.1.



Timestamp	CH A	CH B	CH C	CH N	THD A (%)	THD B (%)	THD C (%)	THD N (%)	Ext Temp 1 (C)	Ext Temp 2 (C)	Internal Temp (C)
12/02/2015 5:20:00 PM	918.8	542.4	663.7	930.9	-100.0	-100.0	-100.0	-100.0	6310.2	6309.7	28.0
13/02/2015 9:10:00 AM	79.6	181.4	66.9	31.8	-100.0	-100.0	-100.0	-100.0	6310.2	30.0	26.3
13/02/2015 9:20:00 AM	162.6	176.0	167.7	37.9	-100.0	-100.0	-100.0	-100.0	24.2	30.0	27.0
13/02/2015 9:30:00 AM	196.9	187.1	152.4	64.9	-100.0	-100.0	-100.0	-100.0	24.1	30.2	27.1
13/02/2015 9:40:00 AM	188.9	201.0	138.9	78.7	-100.0	-100.0	-100.0	-100.0	24.1	30.5	27.4
13/02/2015 9:50:00 AM	207.5	219.3	166.2	69.7	-100.0	-100.0	-100.0	-100.0	24.4	30.8	27.7
13/02/2015 10:00:00 AM	211.7	214.9	168.5	68.6	-100.0	-100.0	-100.0	-100.0	24.7	31.2	28.5
13/02/2015 10:10:00 AM	212.7	213.4	174.2	60.5	-100.0	-100.0	-100.0	-100.0	25.1	31.4	29.0
13/02/2015 10:20:00 AM	222.3	240.6	181.9	66.5	-100.0	-100.0	-100.0	-100.0	25.9	32.3	29.9
13/02/2015 10:30:00 AM	225.5	234.9	193.8	58.8	-100.0	-100.0	-100.0	-100.0	26.8	33.1	31.4
13/02/2015 10:40:00 AM	218.9	223.1	182.7	60.5	-100.0	-100.0	-100.0	-100.0	26.1	33.0	32.0
13/02/2015 10:50:00 AM	211.3	219.8	182.3	56.7	-100.0	-100.0	-100.0	-100.0	25.6	32.9	31.1
13/02/2015 11:00:00 AM	208.4	234.9	178.6	72.8	-100.0	-100.0	-100.0	-100.0	25.4	32.6	30.1
13/02/2015 11:10:00 AM	213.7	226.5	177.7	65.0	-100.0	-100.0	-100.0	-100.0	25.9	32.6	29.5
13/02/2015 11:20:00 AM	211.5	221.8	185.6	54.2	-100.0	-100.0	-100.0	-100.0	26.2	33.2	29.4
13/02/2015 11:30:00 AM	220.6	229.3	189.3	52.1	-100.0	-100.0	-100.0	-100.0	26.4	33.3	29.5
13/02/2015 11:40:00 AM	228.2	234.2	181.2	67.7	-100.0	-100.0	-100.0	-100.0	26.9	33.5	29.4
13/02/2015 11:50:00 AM	239.3	248.6	189.8	73.0	-100.0	-100.0	-100.0	-100.0	28.1	33.8	30.0
13/02/2015 12:00:00 PM	236.5	248.3	177.5	88.6	-100.0	-100.0	-100.0	-100.0	28.4	34.3	30.6
13/02/2015 12:10:00 PM	232.2	248.1	175.6	92.4	-100.0	-100.0	-100.0	-100.0	28.3	34.5	30.8
13/02/2015 12:20:00 PM	227.9	233.5	163.5	88.8	-100.0	-100.0	-100.0	-100.0	27.7	34.6	30.8
13/02/2015 12:30:00 PM	227.7	240.3	169.6	88.8	-100.0	-100.0	-100.0	-100.0	28.3	34.3	30.6
13/02/2015 12:40:00 PM	219.7	222.2	159.3	81.0	-100.0	-100.0	-100.0	-100.0	28.2	33.6	30.3
13/02/2015 12:50:00 PM	228.7	224.8	159.5	81.8	-100.0	-100.0	-100.0	-100.0	28.4	33.6	30.2
13/02/2015 1:00:00 PM	243.4	231.2	162.4	90.0	-100.0	-100.0	-100.0	-100.0	28.9	34.3	30.1
13/02/2015 1:10:00 PM	258.2	244.3	164.9	101.1	-100.0	-100.0	-100.0	-100.0	29.7	34.9	30.8
13/02/2015 1:20:00 PM	269.0	250.3	180.8	95.5	-100.0	-100.0	-100.0	-100.0	29.7	35.6	31.3
13/02/2015 1:30:00 PM	262.9	248.1	167.2	109.0	-100.0	-100.0	-100.0	-100.0	29.6	35.6	31.7

Figure 2.12.7.1

2.12.8 Show alarms

Step 1: Click on the 'Show Alarms' button. A list of alarms is displayed in a table as shown in figure 2.12.8.1.

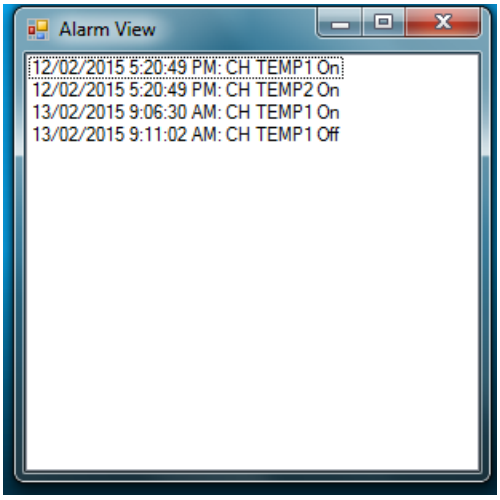


Figure 2.12.8.1

2.12.9 Add another file

This feature provides the option to open multiple data files and view them together on the same chart.

Step 1: Click on the 'Add Other file' button. A browsing window opens as shown in figure 2.12.9.1.

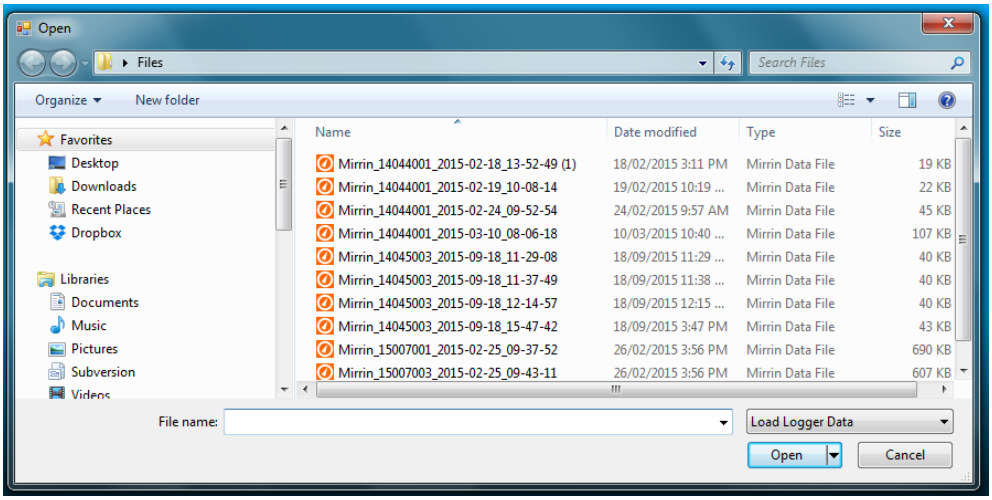


Figure 2.12.9.1

Step 2: Select one additional file and click the 'Open' button. The chart can now display all traces from both files.

It is possible to open multiple files. It is not possible to remove files. You must close the chart viewing window and again use the 'Open Data File' button on the main 'Citrus' application menu shown in figure 2.12.1 to open the desired file.

3 Citrus Lite Application Software

Two versions of Citrus Lite have been developed to operate on Android and iOS platforms.

3.1 Citrus Lite Android software application

3.1.1 Installing the Citrus Lite Android software application

Step 1: Using your Android device click on the following link http://www.chkpowerquality.com.au/downloads/ which takes you to the 'Downloads' page of the CHK Power Quality website

Step 2: On the 'Downloads' page click on 'Citrus Lite Android App' as shown in figure 3.1.1.1.

A file named Citruslitevx.x.apk will appear in the 'Downloads' folder (in the main directory) as shown in figure 3.1.1.2 and figure 3.1.1.3. The file version number is 1.2 at the time of writing this document.

Figure 3.1.1.1

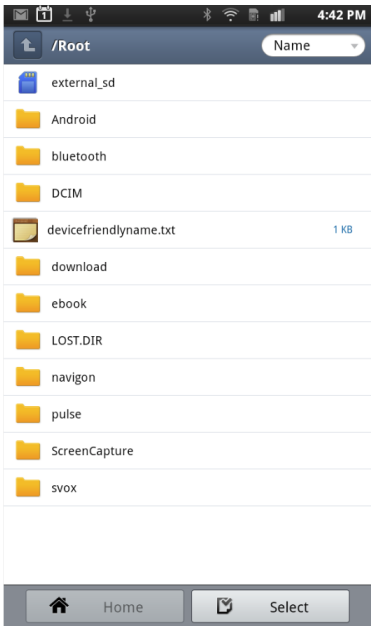


Figure 3.1.1.2

Step 3: Click on the latest version. The window in figure 3.1.1.4 appears.

Step 4: Press 'OK'. The window in figure 3.1.1.5 appears.

Step 5: Press 'Install'. The window in figure 3.1.1.6 appears. The Citrus Lite Android software application is now being installed. Upon completion figure 3.1.1.7 appears.

Step 6: Press 'Done'. The active window closes; press 'Open' to start the application. The window in figure 3.1.1.8 appears.

Step 7: Go back to the desktop. Citrus Lite is now available and ready to use as shown in figure 3.1.2.1.

Figure 3.1.1.3

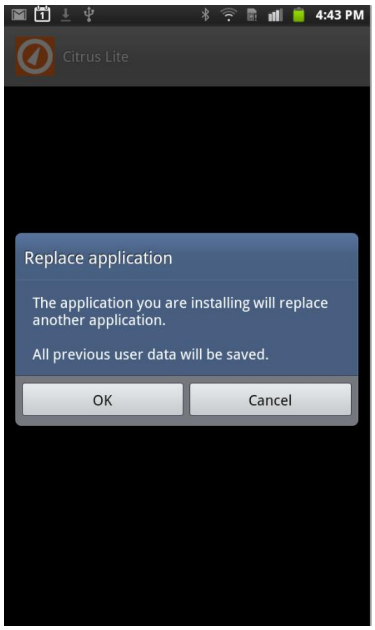


Figure 3.1.1.4

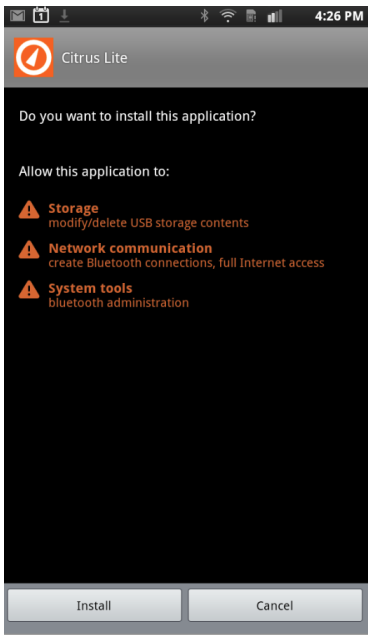


Figure 3.1.1.5

Figure 3.1.1.6

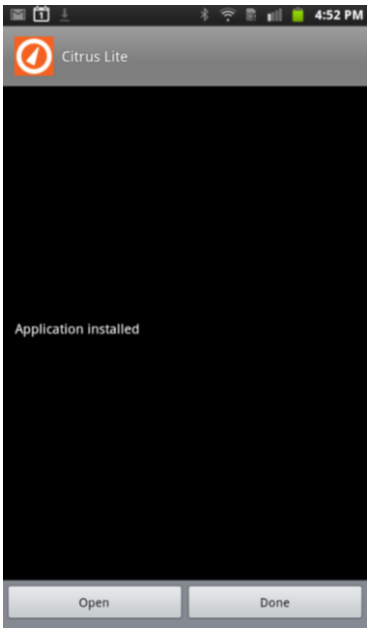


Figure 3.1.1.7

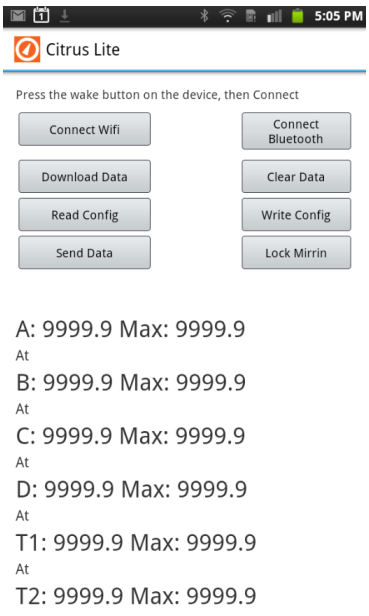


Figure 3.1.1.8

On this platform you are able to connect to the MLL which is Bluetooth or WiFi enabled.

3.1.2 Connecting to the MLL using Citrus Lite

Step 1: Download Citrus Lite onto your Android based device. An icon will appear as shown in figure 3.1.2.1.

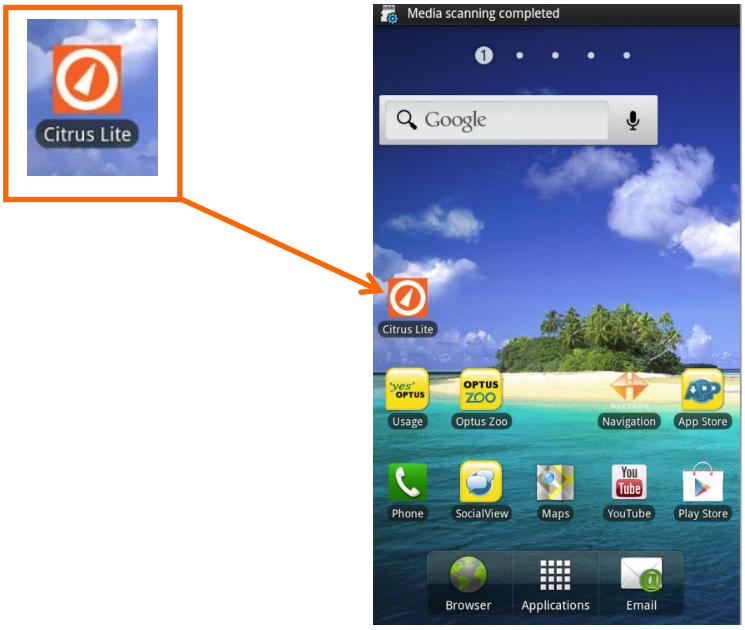


Figure 3.1.2.1

Step 2: Click on the icon in figure 3.1.2.1 and the status screen in figure 3.1.2.2 appears. Scrolling up will show an empty graph as shown in figure 3.1.2.3.

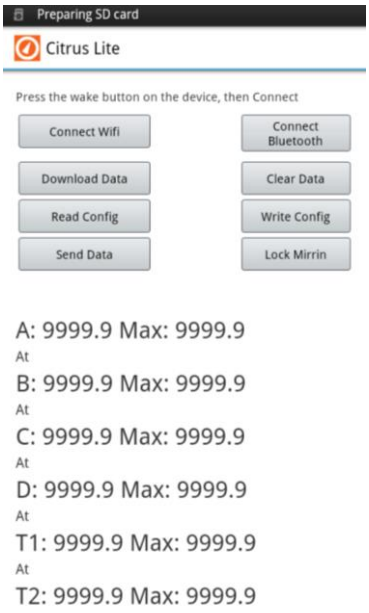


Figure 3.1.2.2

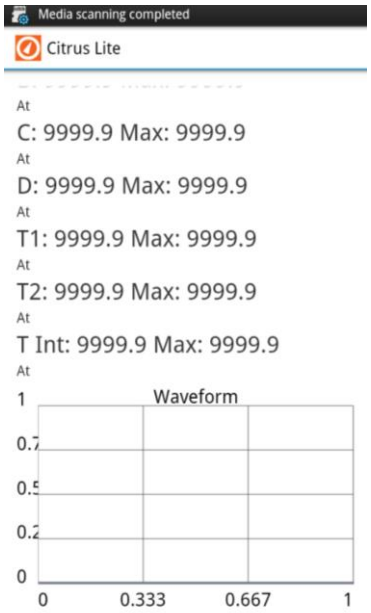


Figure 3.1.2.3

Step 3: Click on 'Connect Wifi' or 'Connect Bluetooth button' (this depends upon what local communications is enabled in the MLL) and the screen in figure 3.1.2.4 appears where the Android device will commence searching for MLL devices.

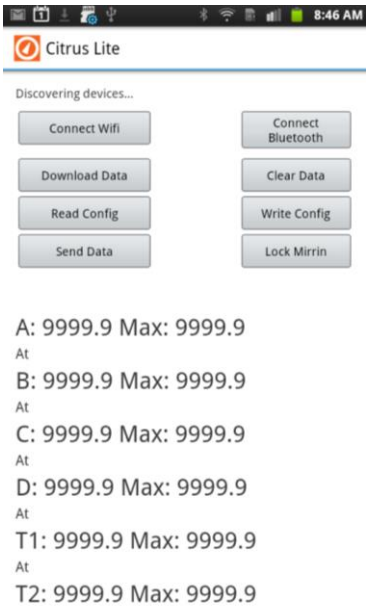


Figure 3.1.2.4

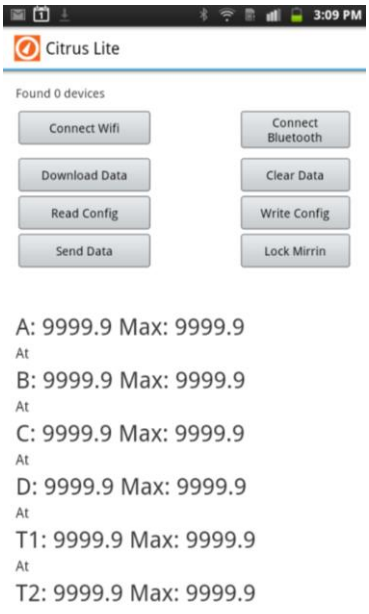


Figure 3.1.2.5

If it does not find any, it will report 'Found 0 devices' as shown in figure 3.1.2.5.

If the Android device has found some MLL devices it will display 'Found x devices', where x is the total number of active MLL devices, and lists them as shown in figure 3.1.2.6.

Step 4: Select the desired MLL device from the list shown in figure 3.1.2.6.

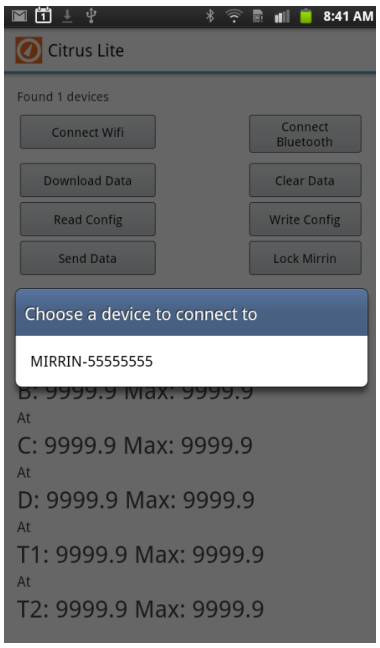


Figure 3.1.2.6

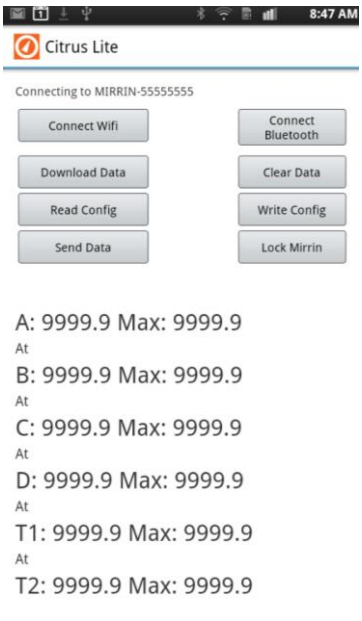


Figure 3.1.2.7

The Android device will then attempt to connect to the MLL as shown in figure 3.1.2.7. If successful, the status window will appear as shown in figure 3.1.2.8.

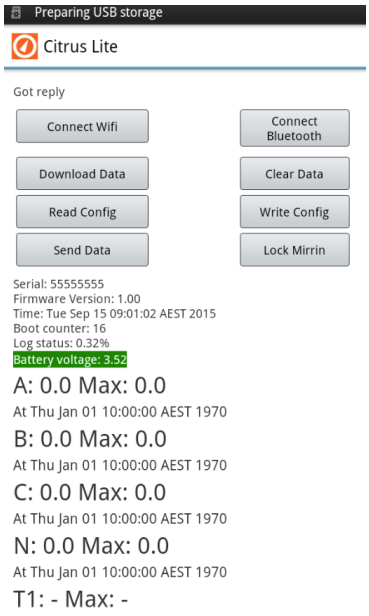


Figure 3.1.2.8

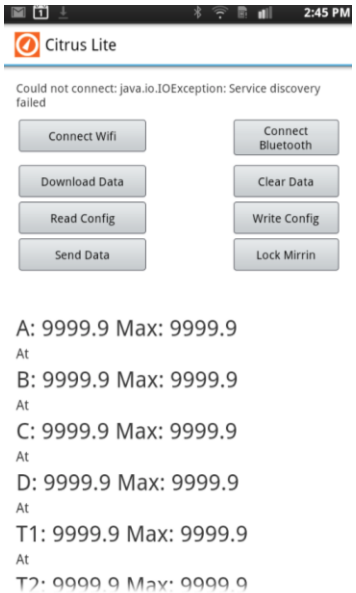


Figure 3.1.2.9

Else the screen shown in figure 3.1.2.9 will appear. This can occur if the user takes too long (more than 60 seconds) to select the MLL device from the list shown in figure 3.1.2.6.

3.1.3 Status

Connection to the MLL without current sensors connected.

If connected the screen in figure 3.1.2.4 will populate with the most recent values as shown in figure 3.1.3.1 and updated every 2.5 seconds. Note no measurements for currents. Accordingly, no waveforms as shown in figure 3.1.3.2.

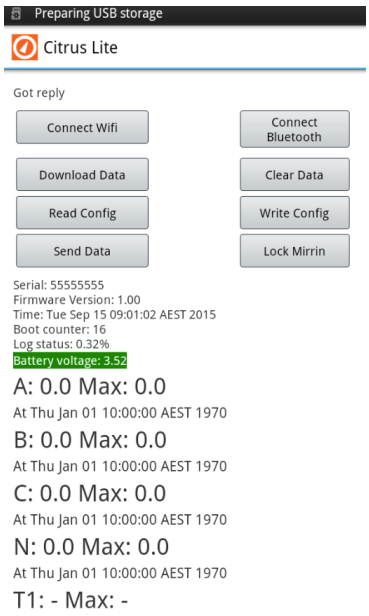


Figure 3.1.3.1

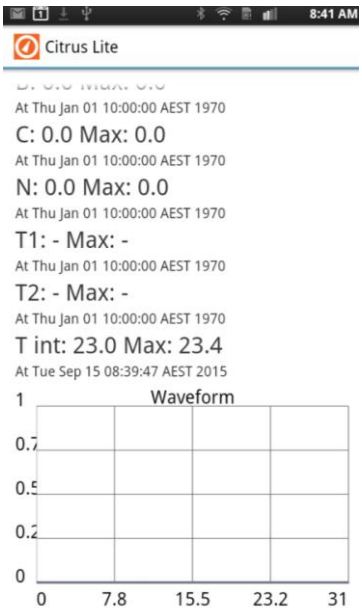


Figure 3.1.3.2

Connection to the MLL with one current sensor connected to channel A.

Channel A will display the rms value as shown in figure 3.1.3.3 and updated every 2.5 seconds. Accordingly, the waveforms will update displaying only channel A as shown in figure 3.1.3.4.

Figure 3.1.3.3

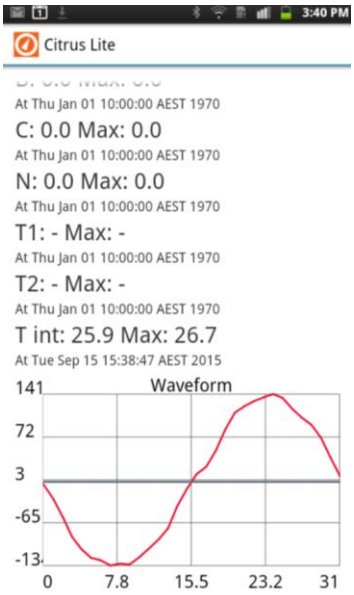


Figure 3.1.3.4

3.1.3.1 Serial number

The 'Serial' as shown in figure 3.1.3.1.1 refers to the serial number of the MLL.

Figure 3.1.3.1.1

3.1.3.2 Firmware version

The 'Firmware version' as shown in figure 3.1.3.2.1 refers to the version number of the firmware in the MLL.

Figure 3.1.3.2.1

3.1.3.3 Date and time

The 'Time' as shown in figure 3.1.3.3.1 is the date and time read back from the MLL's real time clock and updated every three seconds.

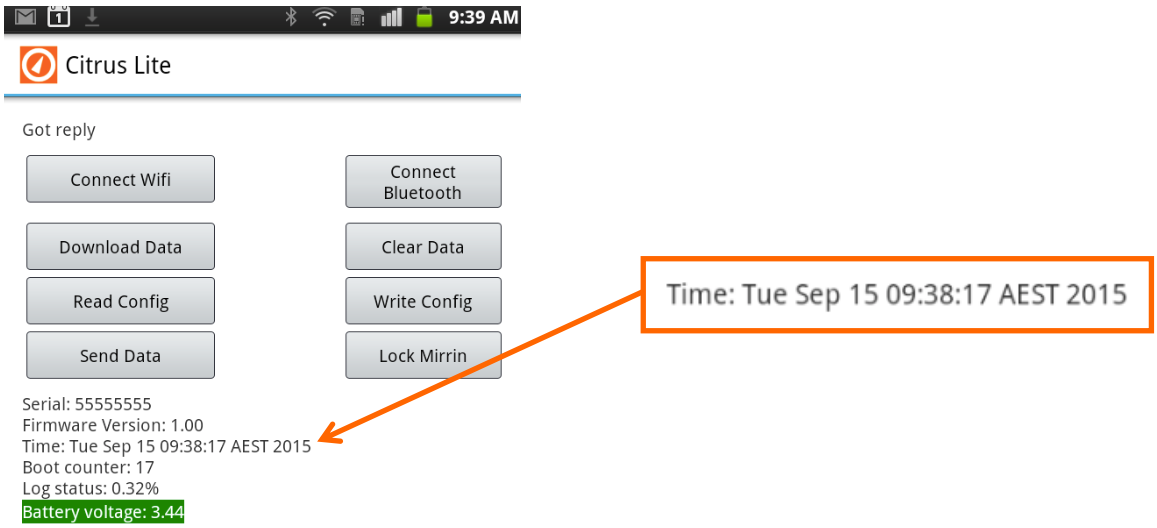


Figure 3.1.3.3.1

3.1.3.4 Boot counter

The 'Boot counter' as shown in figure 3.1.3.4.1 essentially monitors the number of power-up cycles and is provided for diagnostic purposes only.

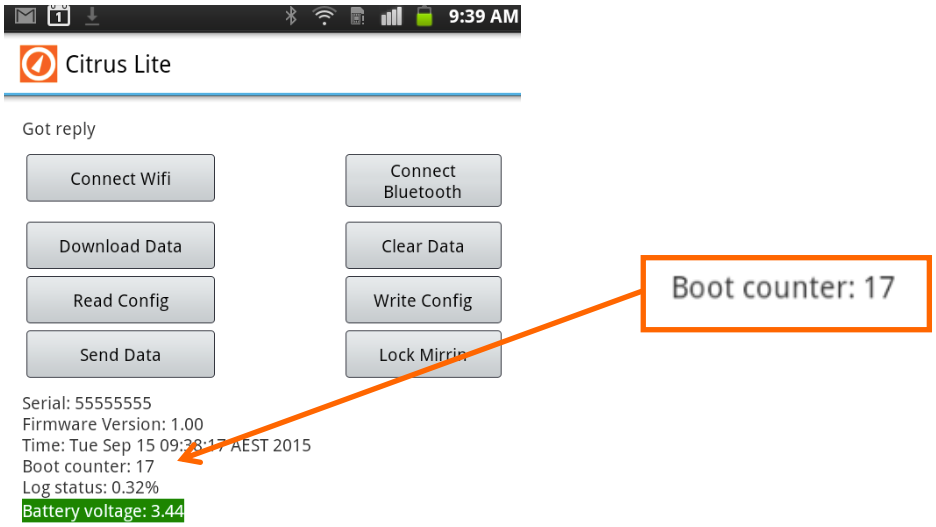


Figure 3.1.3.4.1

3.1.3.5 Log status

The 'Status Log' as shown in figure 3.1.3.5.1 displays the percentage amount of log memory utilised in the MLL.

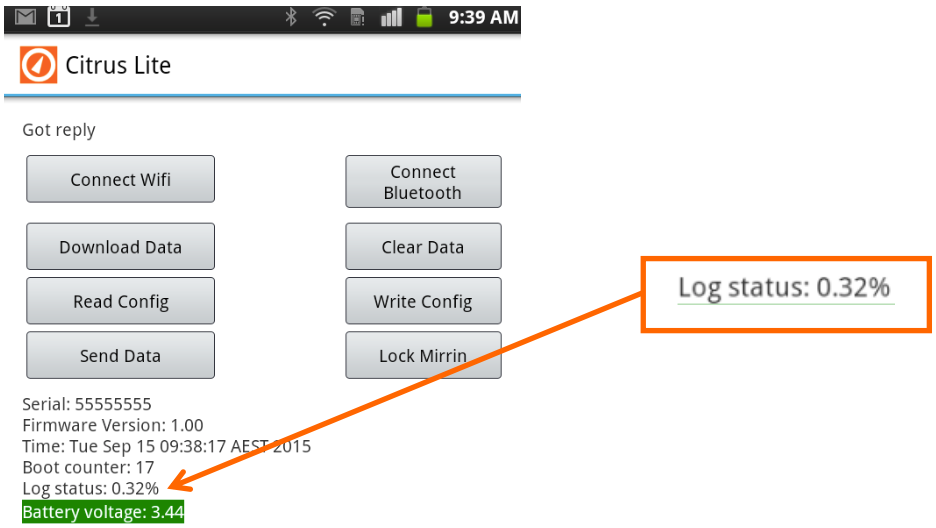


Figure 3.1.3.5.1

3.1.4 Configuration

Step 1: Click on the 'Read Config' button as shown in figure 3.1.4.1 and the screen in figure 3.1.4.2 appears showing key configuration parameters.

Figure 3.1.4.1

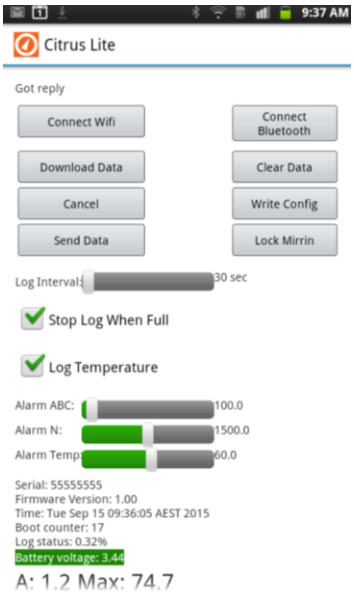


Figure 3.1.4.2

The user is able to alter:

- Log Interval via a scroll bar;
- Log Temperature;
- Alarm settings for current and temperature channels; and
- Halt logging when memory is full.

Step 2: Click on the 'Write Config' button as shown in figure 3.1.4.2 to update the MLL with the new configuration parameters.

Step 3: Click on the 'Cancel' button to take you back to the status window as shown in figure 3.1.4.1.

3.1.5 Clear data

Note that the 'Log status' reading in figure 3.1.5.1 is currently set to 0.32%.

Step 1: Click on 'Clear Data' button shown in figure 3.1.5.1. The popup message window appears as shown in figure 3.1.5.2.

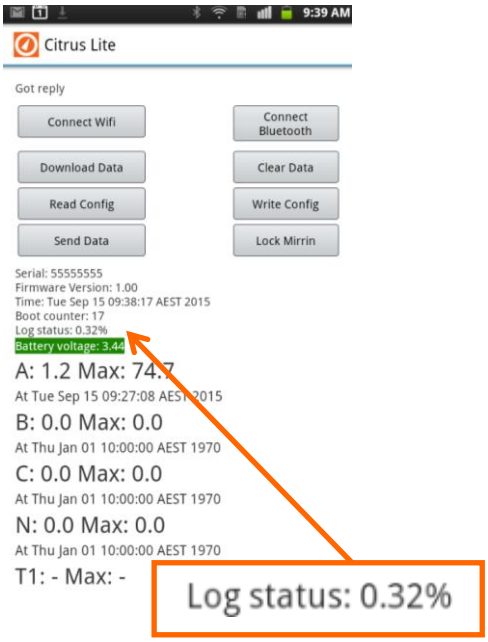


Figure 3.1.5.1

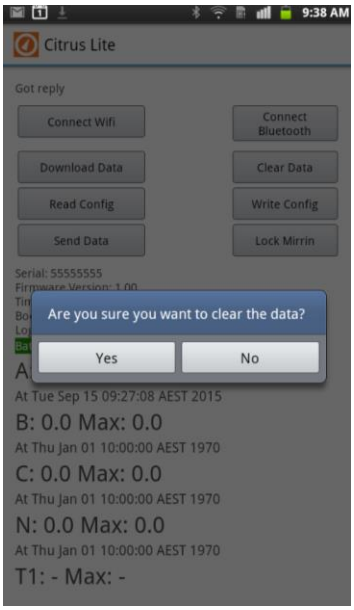


Figure 3.1.5.2

Step 2: Click on the 'Yes' button to confirm. The popup message window closes and the 'Log status' is reset to zero as shown in figure 3.1.5.3.

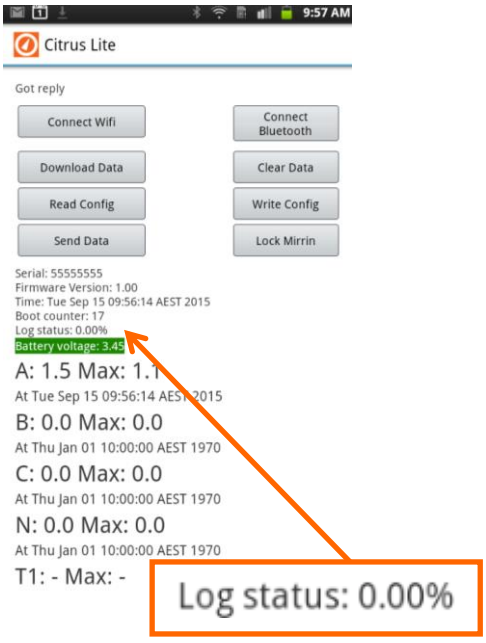


Figure 3.1.5.3

3.1.6 Download data

Step 1: Click on the 'Download Data' button as shown in figure 3.1.6.1 and the screen in figure 3.1.6.2 appears showing that logged data is being read and saved to the Android device.

Figure 3.1.6.1

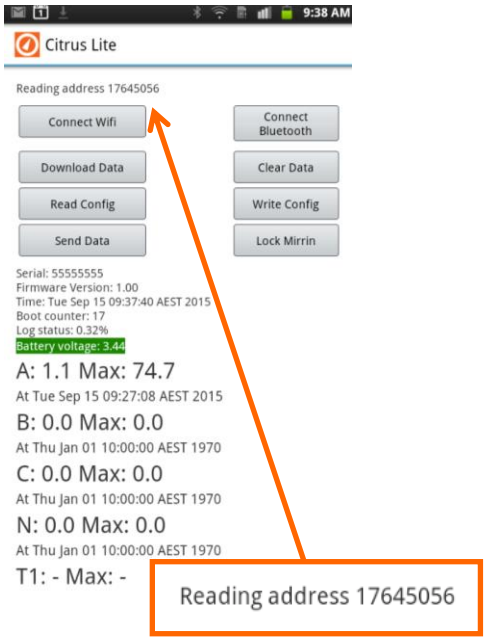


Figure 3.1.6.2

Once completed the screen appears as shown in figure 3.1.6.3 highlighting 'Download complete'.

Figure 3.1.6.3

3.1.7 Send data

Once data has been downloaded you have the option to email the data file via the 'Send Data button.

Step 1: Click on the 'Send Data' button as shown in figure 3.1.7.1 and the screen in figure 3.1.7.2 appears showing a list of downloaded data files.

Figure 3.1.7.1

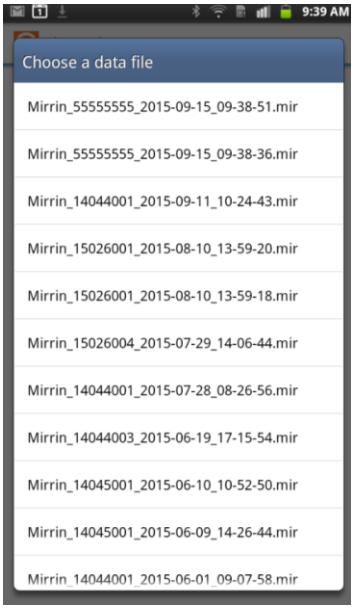


Figure 3.1.7.2

Step 2: Select any file.

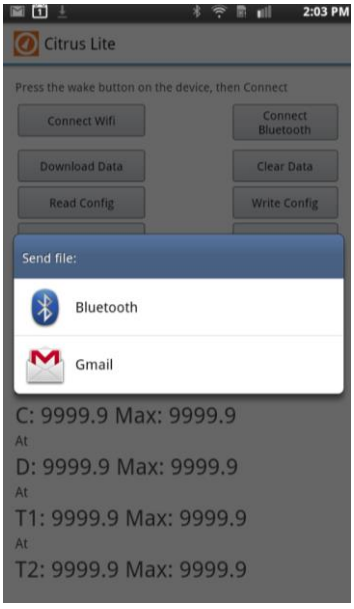


Figure 3.1.7.3

Figure 3.1.7.4

Step 3: The popup message window as shown in figure 3.1.7.3 appears. In this case, select 'Gmail'. The mail form as shown in figure 3.1.7.4 appears. Fill in the required fields and press the send icon.

Step 4: The popup message window in figure 3.1.7.5 appears. Click the 'OK' button. The mail with the attached data file should appear at the recipient's mailbox as shown in figure 3.1.7.6.

Figure 3.1.7.5

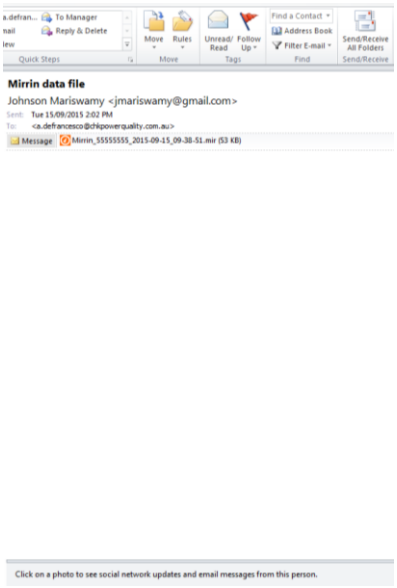


Figure 3.1.7.6

3.1.8 Lock / Unlock

Step 1: Click the 'Lock Mirrin' button on the status screen as shown in figure 3.1.8.1. The popup window asking to enter a PIN appears as shown in figure 3.1.8.2.

Step 2: In figure 3.1.8.2 click in the available cell next to the cursor. A number keyboard appears as shown in figure 3.1.8.3.

Figure 3.1.8.1

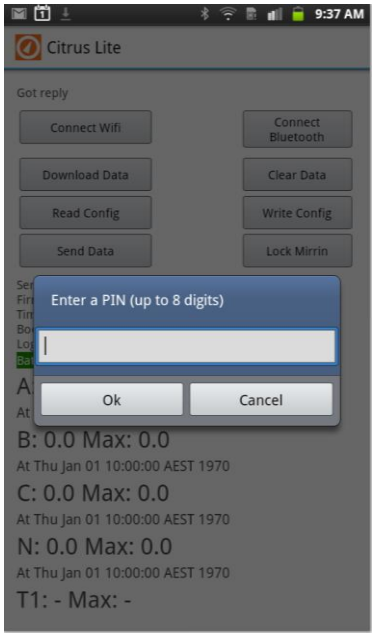


Figure 3.1.8.2

Figure 3.1.8.3

Figure 3.1.8.4

Step 3: Enter the required PIN and click the 'Ok' button. The popup window closes. As shown in figure 3.1.8.4 some functions of the status screen are now unavailable and the 'Lock Mirrin' button now changes to the 'Unlock Mirrin' button.

Step 4: To unlock the Mirin, click the 'Unlock Mirrin' button on the status screen as shown in figure 3.1.8.4. The popup window asking to enter a PIN appears as shown in figure 3.1.8.2. Again enter the PIN and click the 'Ok' button. The status screen as shown in figure 3.1.8.1 will appear.

3.2 Citrus Lite iOS software application

3.2.1 Installing the Citrus Lite iOS software application

Step 1: Using your iOS device locate the 'App Store' icon a shown in figure 3.2.1.1 and click on it.

Step 2: Click on the 'Search' icon as shown in figure 3.2.1.2. Figure 3.2.1.3 appears.

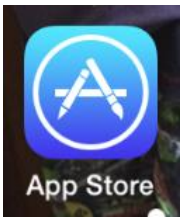


Figure 3.2.1.1

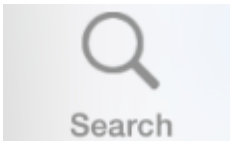


Figure 3.2.1.2

Step 3: Type in 'Citrus Lite' and click on the 'Search' button (with the blue background) as shown in figure 3.2.1.3.

Step 4: You should then be able to scroll and locate the 'Citrus Lite' application as shown in figure 3.2.1.4.

Step 5: Click on the cloud icon shown in figure 3.2.1.4. The cloud now changes to a 'working' icon as shown in figure 3.2.1.5. Once completed it again changes to 'Open' as shown in figure 3.2.1.6.

Step 6: Click on 'Open' to start the application as shown in figure 3.2.1.7.

Step 7: Close the application and on the desktop you should now have the 'Citrus Lite' icon as shown in figure 3.2.1.8.

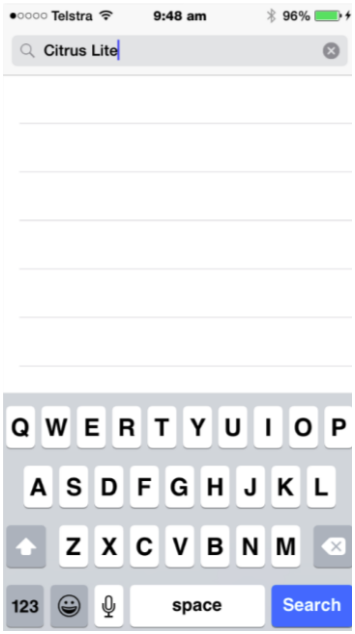


Figure 3.2.1.3

Figure 3.2.1.4

Figure 3.2.1.5

Figure 3.2.1.6

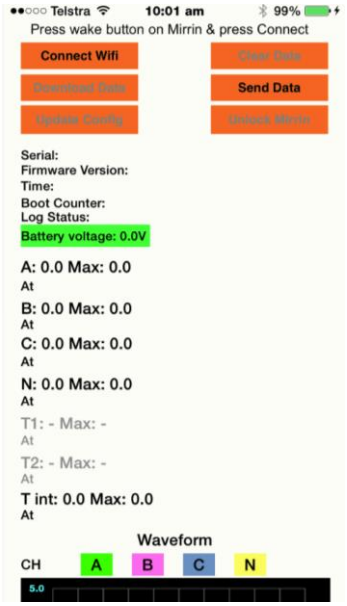


Figure 3.2.1.7

Figure 3.2.1.8

3.2.2 Configuring the iOS device

Step 1: Download 'Citrus Lite' onto your iOS based device.

Step 2: Click on the 'Settings icon' as shown in figure 3.2.2.1, locate the 'Wi-Fi' icon as shown in figure 3.2.2.2 and click it.

Step 3: Press the button on the MLL to wake up its Wi-Fi communications module. You should see the MLL with its associated serial number appear in the 'choose a network' list as shown in figure 3.2.2.3.

Step 4: Click on the MLL device. The MLL should now appear above the list and ticked as shown in figure 3.2.2.4.

Figure 3.2.2.1

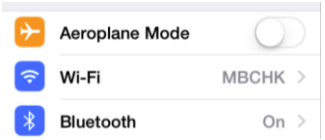


Figure 3.2.2.2

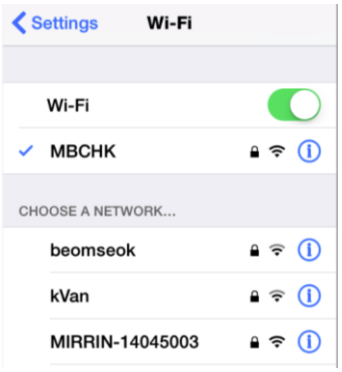


Figure 3.2.2.3

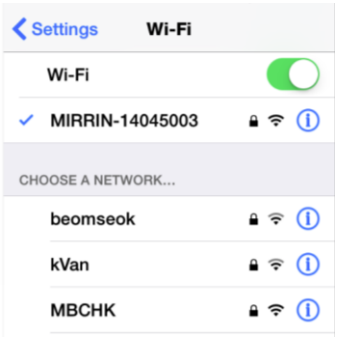


Figure 3.2.2.4

Step 5: Close 'Settings' and go to the desktop and click on the 'Citrus Lite' icon shown in figure 3.2.1.8.

Step 6: Click on the 'Connect WiFi' button. Upon a successful connection all other buttons become active and status information read back from the MLL, as shown in figures 3.2.2.5 and 3.2.2.6.

Figure 3.2.2.3a

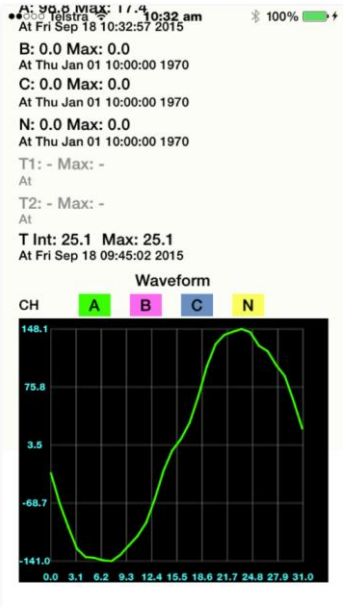


Figure 3.2.2.3b

4 Operation

4.1 Field installation procedure

The MLL should be installed in accordance with appropriate Live Installation instructions and procedures.

Step 1: Please install the MLL according to section 4.1.1 or section 4.1.2. Mount the MLL on a pole pin when used on overhead mains and on a hook in kiosks or sub-stations. In both cases secure the MLL with a lanyard.

Step 2: You can connect any current sensor to any of the four input channels at any time. The MLL will automatically detect the type of current sensor to produce the correct current reading.

Step 3: Activate the LCD and Bluetooth or WiFi by pressing down on the 'Press' button until the display is shown. This takes approximately one second. Check that the heartbeat LED is flashing blue. Also check that the instantaneous current readings on the display correspond to expected readings.

4.1.1 Flanged enclosure

Where the MLL is supplied with a flanged enclosure, holes exist at the top and bottom of the flange as shown in figure 4.1.1.1 for pole pin or hook mounting.

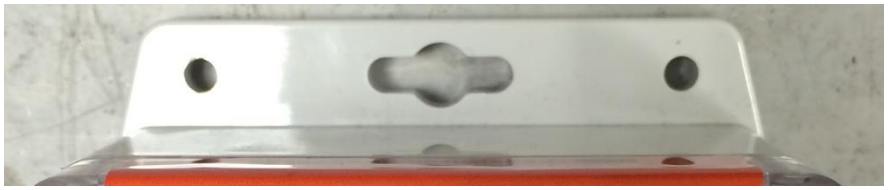


Figure 4.1.1.1

4.1.2 Backplane

Step 1: Where the MLL is supplied without a flanged enclosure. Turn the MLL shown in figure 4.1.2.1 upside down as shown in figure 4.1.2.2.

Figure 4.1.2.1

Figure 4.1.2.2

Ensure the four holes contain brass inserts as shown in figure 4.1.2.2.

Step 2: Screw the provided backplane with four stainless steel M5 x 16mm pan screws as shown in figure 4.1.2.3 and turn the MLL over as shown in figure 4.1.2.4.

Figure 4.1.2.3

Figure 4.1.2.4

Address: Unit 102, 25 Angas Street
Meadowbank NSW 2114, Sydney Australia
Website: www.chkpowerquality.com.au
Telephone: +61 2 8283 6945
Fax: +61 2 8212 8105
ABN: 53 169 840 831

4.2 Battery replacement

The batteries are accessed by unscrewing the four stainless steel screws on the top of the unit shown in figure 4.1.2.1 and removing the lid. The battery holder is fitted on to the bottom PCB.

After replacing the batteries please check that the gasket is in good condition and seated correctly in the groove of the lid before re-fitting the lid.

Address: Unit 102, 25 Angas Street
Meadowbank NSW 2114, Sydney Australia
Website: www.chkpowerquality.com.au
Telephone: +61 2 8283 6945
Fax: +61 2 8212 8105
ABN: 53 169 840 831

5 Service and Support

5.1 Calibration

The MLL is factory calibrated. Calibration of the MLL is recommended every thirty six (36) months.

5.2 Equipment maintenance

Enclosure of the MLL should be inspected for mechanical damage leading to cracking in the case. The integrity of the lid seal should also be inspected.

5.3 Cleaning and decontamination

The case of the MLL can be cleaned with a cloth moistened with Isopropyl Alcohol. There are no decontamination issues.

5.4 Technical support

We provide complementary technical support. Please contact our Technical Services Manager at:

sales@chkpowerquality.com.au

6 Specifications

PARAMETER	MIRRIN MULTI-CHANNEL LOAD LOGGER
Input Channels	
Current Inputs (AC RMS)	4 channels - Phases A, B, C and Neutral
Temperature Inputs (optional)	2 x PT100 RTD
Communications	
Serial Data (standard)	TTL serial; Baud Rate: 230400
Wireless (optional)	Bluetooth or WiFi enabled
Sampling	
A to D Conversion	12 bits
Sampling Rate	1600Hz (1600 samples per second)
Instantaneous measurement	RMS aggregation of four cycles 250ms apart and updated every second
Maximum measurement	Based on the instantaneous measurements using a 60-second exponential time constant.
Logging	
Logged Data Memory	256KB; expandable to 8GB (SD card)
Logging Interval	Programmable from 1 second
Measurements	Current (RMS), Max. Current (RMS), Current Unbalance (not yet implemented), Temperature (not yet implemented)
Accuracy	±0.5% (excludes current sensor)
System Accuracy	±1% (clamp-on current sensor)
Outputs	
Visual Tools	Graphical Interface
Data File	Mirrin format binary with CSV export
Visual Indicator	2 x Status LED
General	
Display (optional)	LCD: Time-stamped current and max. current
Current Sensors	Flexible current sensors or clamp-on current probes - Automatic detection
Battery Supply	Two non-rechargeable ‘AA” cells. Energizer® Ultimate Lithium AA batteries recommended.
External Supply	5V dc adaptor.
Battery Life	Four months typical. Extended to twelve months in Power Saving Mode
Environment	
Use	Indoor and outdoor
Altitude	Up to 2000m.
Operating Temperature	-20°C to 70°C
Relative Humidity	80% for temperatures up to 70°C
Degree of Protection	IP65
Safety Category	IEC 61010-1,CAT IV 600V defined by CT
Electromagnetic Compatibility	
Emissions	AS/NZS CISPR 22: 2002 Class A
Immunity	EN61000-4-3:1995, including Amdt 1:1998
Physical	
Dimensions (H x W x L)	55 x 90 x 145 mm
Weight	400g (battery included)
Case Material and Colour	Polycarbonate, moulded in light grey